AD-A147 283 INSTALLATION RESTORATION PROGRAM PHASE II--CONFIRMATION/QUANTIFICATION ST..(U) WATER AND AIR RESEARCH INC GAINESVILLE FL W D ADAMS ET AL. SEP 84 1/3

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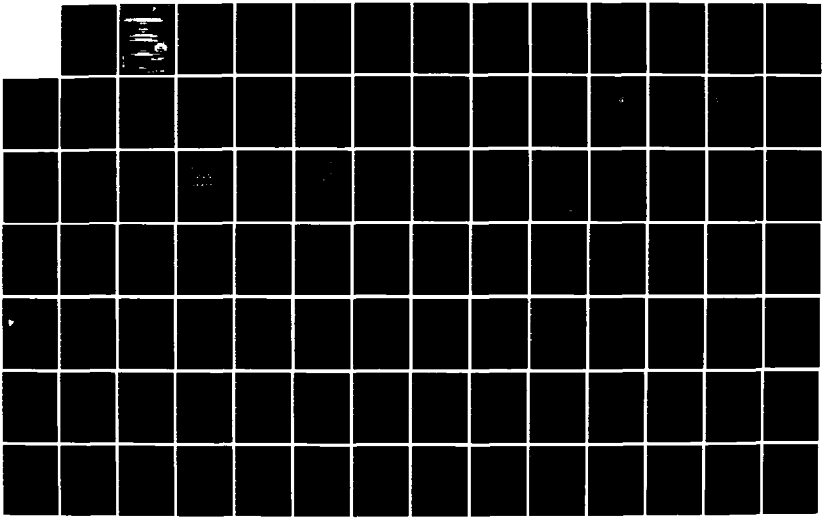

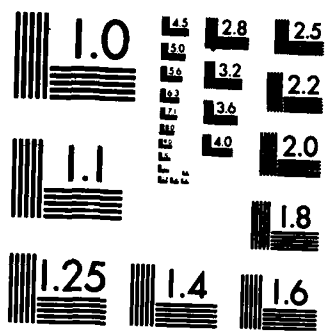
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MacDill AFB	Specific conductance
Groundwater	Dissolved organic carbon (DOC)
Water table aquifer	Total organic halides (TOX)
Floridan Aquifer	(Cont.)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Phase IIb Installation Restoration Program (IRP) Field Confirmation Study for MacDill Air Force Base (AFB) concerned seven sites at MacDill AFB and three sites at Avon Park Air Force Range (AFR). Five of the sites were former landfills, two were fuel storage areas, one was a pair of fire training areas, one was a drum storage area, and one was a

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19. Oil and grease
Polychlorinated biphenyls (PCBs)
Phenolics
Organochlorine pesticides
Volatile halocarbons
Lead
Volatile aromatics

20. pesticide rinse water basin. The Phase IIb contractor, Water and Air Research, Inc. (WAR), installed monitor wells in the water table aquifer downgradient of each site to determine whether these sites were sources of groundwater contamination.

Most of these analyses were screening tests [phenolics, oil and grease, dissolved organic carbon (DOC), total organic halides (TOX), specific conductance, and pH], which are nonspecific indicators of contamination. The list of analyses also included specific analyses for purgeable organics (solvents), organochlorine pesticides, polychlorinated biphenyls (PCBs), and lead for sites where these specific analyses were deemed appropriate.

Results of the organic screening analyses were positive for every site except the pesticide rinse water basin at Avon Park AFR at which there was no evidence of contamination. High values of specific conductance at many sites may be attributable to tidal influences in adjacent surface waters; however, high specific conductance was not attributable to tidal influences at two wells (MD58-4 and AP6-2). Purgeable organics analyses gave positive results at each of the four wells tested, and the concentration of solvents was elevated (>1,500 ug/l) in one well at the fire training areas. Field measurements determined the presence of a lens of fuel floating on the water table at the former fuel storage area (Site A). The estimated minimum volume of fuel in this lens was 11,300 gallons (42,800 liters). In no case did the analyses for organochlorine pesticides, PCBs, or lead indicate significant contamination attributable to these species.

Consideration of the analytical results dictated the following recommendations:

- Define the areal extent and volume of free-floating fuel product at Site A.
- No further study of the pesticide rinse water basin at Avon Park AFR.
- Investigation of possible fuel leakage from a second former fuel storage area (Site B).
- Further monitoring of all other sites to determine specific components causing positive results of the screening analyses.

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION

STAGE I

FINAL REPORT

FOR

MACDILL AIR FORCE BASE

MACDILL AIR FORCE BASE, FLORIDA

TACTICAL AIR COMMAND

LANGLEY AIR FORCE BASE, VIRGINIA 23665

SEPTEMBER 29, 1984

PREPARED BY

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A-1

PREPARED FOR

UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AIR FORCE BASE, TEXAS 78235

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SUMMARY

SUMMARY

The Phase IIb Installation Restoration Program (IRP) Field Confirmation Study for MacDill Air Force Base (AFB) concerned seven sites at MacDill AFB and three sites at Avon Park Air Force Range (AFR). Five of the sites were former landfills, two were fuel storage areas, one was a pair of fire training areas, one was a drum storage area, and one was a pesticide rinse water basin. Table S-1 lists suspected wastes at each site. The Phase IIb contractor, Water and Air Research, Inc. (WAR), installed monitor wells in the water table aquifer downgradient of each site to determine whether these sites were sources of groundwater contamination.

Groundwater samples from the monitor wells were analyzed for the parameters listed in Table S-2. Most of these analyses were screening tests [phenolics, oil and grease, dissolved organic carbon (DOC), total organic halides (TOX), specific conductance, and pH] which are nonspecific indicators of contamination. The list of analyses also included specific analyses for purgeable organics (solvents), organochlorine pesticides, polychlorinated biphenyls (PCBs), and lead for sites where these specific analyses were deemed appropriate.

Results of the organic screening analyses were positive for every site except the pesticide rinse water basin at Avon Park AFR at which there was no evidence of contamination. High values of specific conductance at many sites may be attributable to tidal influences in adjacent surface waters; however, high specific conductance was not attributable to tidal influences at two wells (MD58-4 and AP6-2). Purgeable organics analyses gave positive results at each of the four wells tested, and the concentration of solvents was elevated (>1,500 ug/l) in one well at the fire training areas. Field measurements determined the presence of a lens of fuel floating on the water table at the former fuel storage area (Site A). The estimated minimum volume of fuel in this lens was 11,300 gallons (42,800 liters). In no case did the analyses for organochlorine pesticides, PCBs, or lead indicate significant contamination attributable to these species.

Table S-1. Phase II Field Evaluation Study Sites at MacDill AFB and Avon Park AFR, Florida (Page 1 of 2)

Site No.	Site Name	Period of Operation	Suspected Types of Waste
MacDill AFB			
16	Fuel Tank Farm--MacDill AFB	1952-Present	Fuel and avgas sludge containing teraethyl lead.
3	Landfill at Dog Kennel	1950-1959	Paint cans, solvents, garbage, PCB-containing capacitors, waste oil, battery casings, empty pesticide and herbicide containers, tires, adhesives, and construction debris.
5-8	Landfills 5-8	1959-1973	Paint cans, solvents, garbage, PCB-containing capacitors, waste oil, battery casings, empty pesticide and herbicide containers, tires, adhesives, construction debris, sewage treatment plant sludge, and avgas sludge containing tetraethyl lead.
9	Landfill 9	1974-1981	Paint cans, solvents, garbage, PCB-containing capacitors, waste oil, battery casings, empty pesticide and herbicide containers, tires, adhesives, construction debris, sewage treatment plant sludge, and avgas sludge containing tetraethyl lead.
A	Former fuel storage area adjacent to AGE--MacDill AFB	1940s to late 1950s	Fuel. Not described in Phase I report.

Table S-1. Phase II Field Evaluation Study Sites at MacDill AFB and Avon Park AFR, Florida (Page 2 of 2)

Site No.	Site Name	Period of Operation	Suspected Types of Wastes
17	Drum storage area--MacDill AFB	1950-1981	Storage of PCB-containing transformers and temporary storage of drums containing waste oils, solvents, and paint. Used for weathering of avgas sludge between 1965 and 1973.
23	Fire training areas--MacDill AFB	1955-Present	Waste fuel, oil, and solvents.
Avon Park AFR			
AP6	Old landfill--Avon Park AFR	1950-1978	Solid waste.
AP7	Current sanitary landfill--Avon Park AFR	1978-Present	Solid waste.
AP11	Pesticide rinse water basin	Not reported	Rinse water from pesticide containers.

Source: Moccia et al., 1981.

Table S-2. Schedule of Samples for MacDill AFB and Avon Park AFR, November 1983

Station	pH	Sp. Cond.	Oil and Grease	Lead	DOC*	TOX	PCBs	Phenolics	Organochlorine Pesticides†	Volatile Aromatics**	Volatile Halocarbons††
MD 16-1	G	G	G	G							
MD 16-2	G	G	G	G							
MD 16-3	G	G	G	G							
MD 16-4	G	G	G	G							
MD 16-5	G	G	G	G							
MD 16-6	G	G	G	G							
MD 16-7	G	G	G	G							
MD 3-1	G	G			G	G	G				
MD 3-2	G	G			G	G	G				G
MD 3-3	G	G			G	G	G				
MD 3-4	G	G			G	G	G				G
MD 3-5	G	G			G	G	G				
MD 58-1	G	G			G	G		G			
MD 58-2	G	G			G	G		G			
MD 58-3	G	G			G	G		G			
MD 58-4	G	G			G	G		G			
MD 9-1	G	G			G	G		G			
MD 9-2	G	G			G	G		G			
MD 9-3	G	G			G	G		G			
MD 17-1	G	G			G	G	G	G			
MD 17-2	G	G			G	G	G	G			
MD 23-1	G	G		G	G	G					
MS 23-2	G	G		G	G	G					
MD 23-3	G	G		G	G	G				G	G
MD 23-4	G	G		G	G	G					
MD 23-5	G	G		G	G	G					
MD 23-6	G	G		G	G	G				G	G
AP 6-1	G	G		G	G	G					
AP 6-2	G	G		G	G	G					
AP 6-3	G	G		G	G	G					
AP 7-1	G	G			G	G		G	G		
AP 7-2	G	G			G	G		G	G		
AP 7-3	G	G			G	G		G	G		
AP 11-1	G	G							G		
AP 11-2	G	G							G		

G = groundwater sample.
*The sample was filtered through a 0.45-micron filter before preservation with H_2SO_4. This ensures that the test results are representative of dissolved species which would migrate in groundwater.
†Organochlorine pesticides (aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, and methoxychlor).
**Volatile aromatics (benzene, ethyl benzene, toluene, and xylene).
††Volatile halocarbons (bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, 2-chloroethylvinyl ether, chloroform, chloromethane, dibromochloromethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, dichlorodifluoromethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, trans-1, 2-dichloroethene, cis-1, 3-dichloropropene, trans-1, 3-dichloropropene, methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, trichlorofluoromethane, vinyl chloride).

Consideration of the analytical results dictated the following recommendations:

- Define the areal extent and volume of free-floating fuel product at Site A.
- No further study of the pesticide rinse water basin at Avon Park AFR.
- Investigation of possible fuel leakage from a second former fuel storage area (Site B).
- Further monitoring of all other sites to determine specific components causing positive results of the screening analyses.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 INSTALLATION RESTORATION PROGRAM BACKGROUND

This report describes Phase IIb of the IRP for MacDill AFB, Florida. Phase IIb pertains to confirmation and quantification of suspected contamination at past hazardous waste disposal sites. MacDill AFB is a Tactical Air Command (TAC) installation.

The United States Air Force (USAF), due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of RCRA, federal agencies are directed to assist the U.S. Environmental Protection Agency (EPA), and under Section 3012 state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, Department of Defense (DOD) developed the IRP. The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by USAF message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous materials handling operations and to control hazards to health and welfare that may have resulted from these past operations. The IRP will be the basis for response actions on USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

The IRP is implemented in four phases. Phase I, Initial Assessment/Records Search, is designed to identify possible hazardous waste contaminated sites and potential problems that may result in contaminant

migration from the installation. The Phase I report, completed for MacDill AFB in November 1981 (Moccia et al., 1981), reviews the history of base operations and waste disposal practices, the geological and hydrogeological conditions which may affect contaminant migration and the ecological setting. All hazardous waste disposal sites identified in the Phase I report are ranked on the basis of a standard evaluation system [Hazardous Assessment Rating Methodology (HARM)], which is applied to all installation record searches. The HARM model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

Phase II, Confirmation and Quantification, is designed to confirm the presence and quantify the extent of contamination caused by migration of hazardous materials from present or abandoned waste disposal sites with HARM rankings indicative of significant environmental contamination. Phase II IRP studies are implemented in two or three parts. Phase IIa, completed for MacDill AFB in January 1983 (WAR, 1983), consists of work plan development and costing of hydrogeological and chemical investigations. Phase IIb, described in this report, consists of field surveys, environmental sampling and analyses, data reduction and interpretation, and development of recommendations for remedial action and/or additional monitoring. Phase IIc, if necessary, provides additional monitoring data upon which design of mitigative actions are based. In Phase III, Technology Base Development, appropriate technology is selected and the engineering design of corrective action options selected for implementation by the USAF is completed. Phase IV, Operations/Remedial Action, involves construction, operation, and maintenance of the corrective action option designed under Phase III.

WAR is currently under contract with the USAF to provide geotechnical, field sampling, analytical, and engineering expertise in the

implementation of Phase II surveys at selected USAF facilities. WAR's contract, number F33615-81-D-4007, has been in effect since July 20, 1981. On September 29, 1982, Delivery Order 0007 was issued under WAR's contract to initiate the Phase IIa presurvey at MacDill AFB. This action was based on results of the MacDill AFB Phase I survey and HARM rankings of the sites investigated. Based on findings of the Phase I records search and Phase IIa presurvey, a scope of work was developed for the MacDill AFB Phase IIb survey. Delivery order 0009 was issued to WAR on August 8, 1983 to initiate this work.

1.2 FACILITY HISTORY

The following discussion was excerpted from the Phase I report (Moccia et al., 1981).

1.2.1 MacDill AFB

MacDill AFB is located on the southernmost tip of the Interbay Peninsula in Hillsborough County, Florida, about 8 miles south of downtown Tampa. Hillsborough Bay borders the base on the east side, and Tampa Bay borders the base on the south; while the northern side of the base borders the city of Tampa. In addition to the 5,621 acres contained within the installation, MacDill AFB supports the following property off-base:

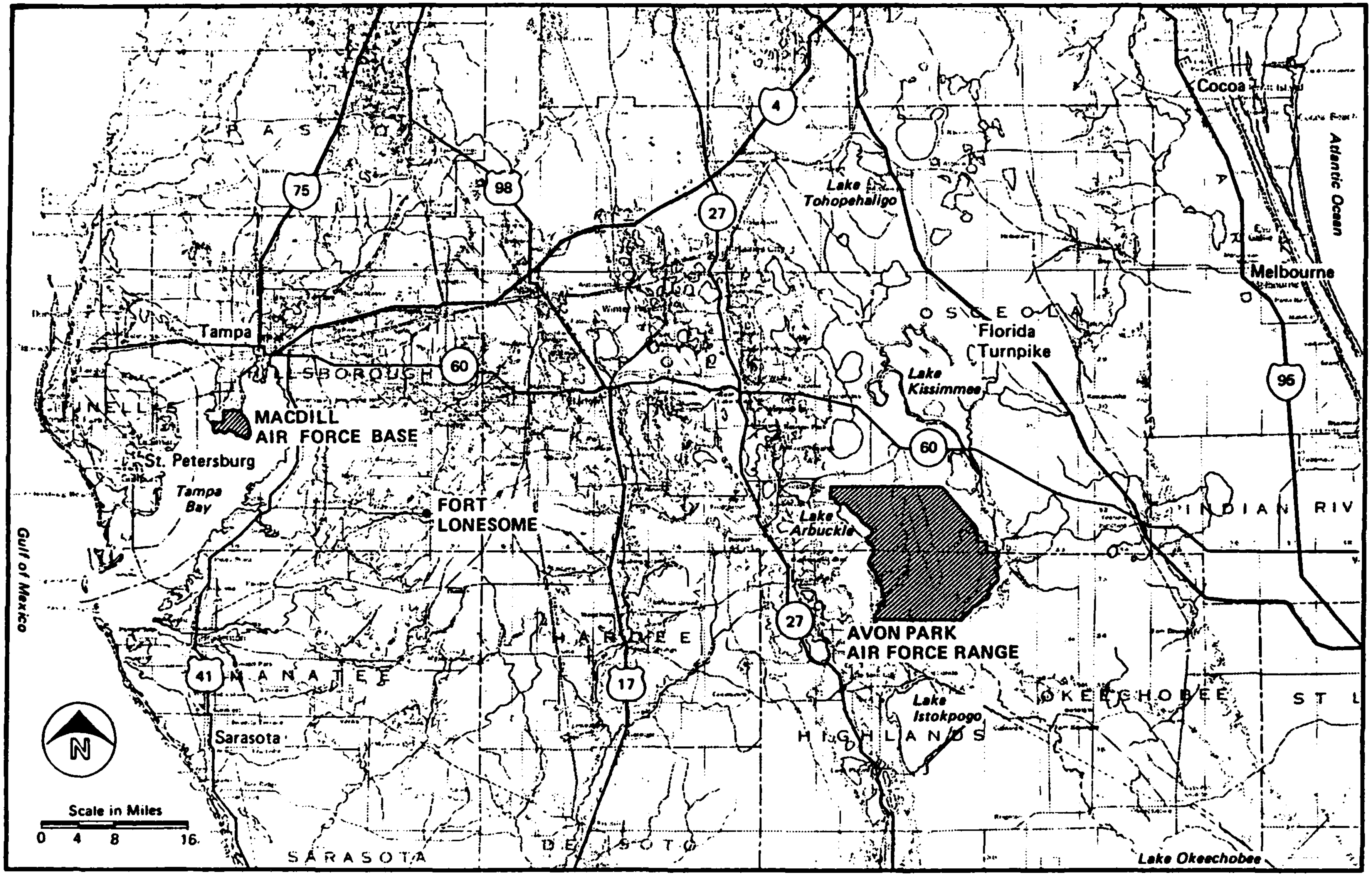
1. Fort Lonesome Radar site, and
2. Avon Park AFR.

The locations of these properties are shown on Figure 1.

Construction of MacDill AFB, acquired for the Army Air Corps, began in December 1939. The base was officially activated in April 1941. After World War II, MacDill became an operational base of the Strategic Air Command (SAC). The base was transferred from SAC to TAC in July 1962.

1.2.2 Avon Park AFR

The Avon Park AFR is located in central Florida in Polk and Highlands Counties, approximately 65 miles east of Tampa. The range covers 106,210 acres, of which 103,484 are unimproved land.



SOURCE: Moccia et al., 1981.

FIGURE 1. Location Map

In 1942, the Army Air Corps constructed the Avon Park range to train air crews for service in World War II. The installation, which at that time included additional acreage leased in Okeechobee County, became the world's largest bombing range. At the end of the war, base personnel dropped to less than 500 people who were involved in stripping and salvaging buildings and equipment. In 1950, the base was officially deactivated.

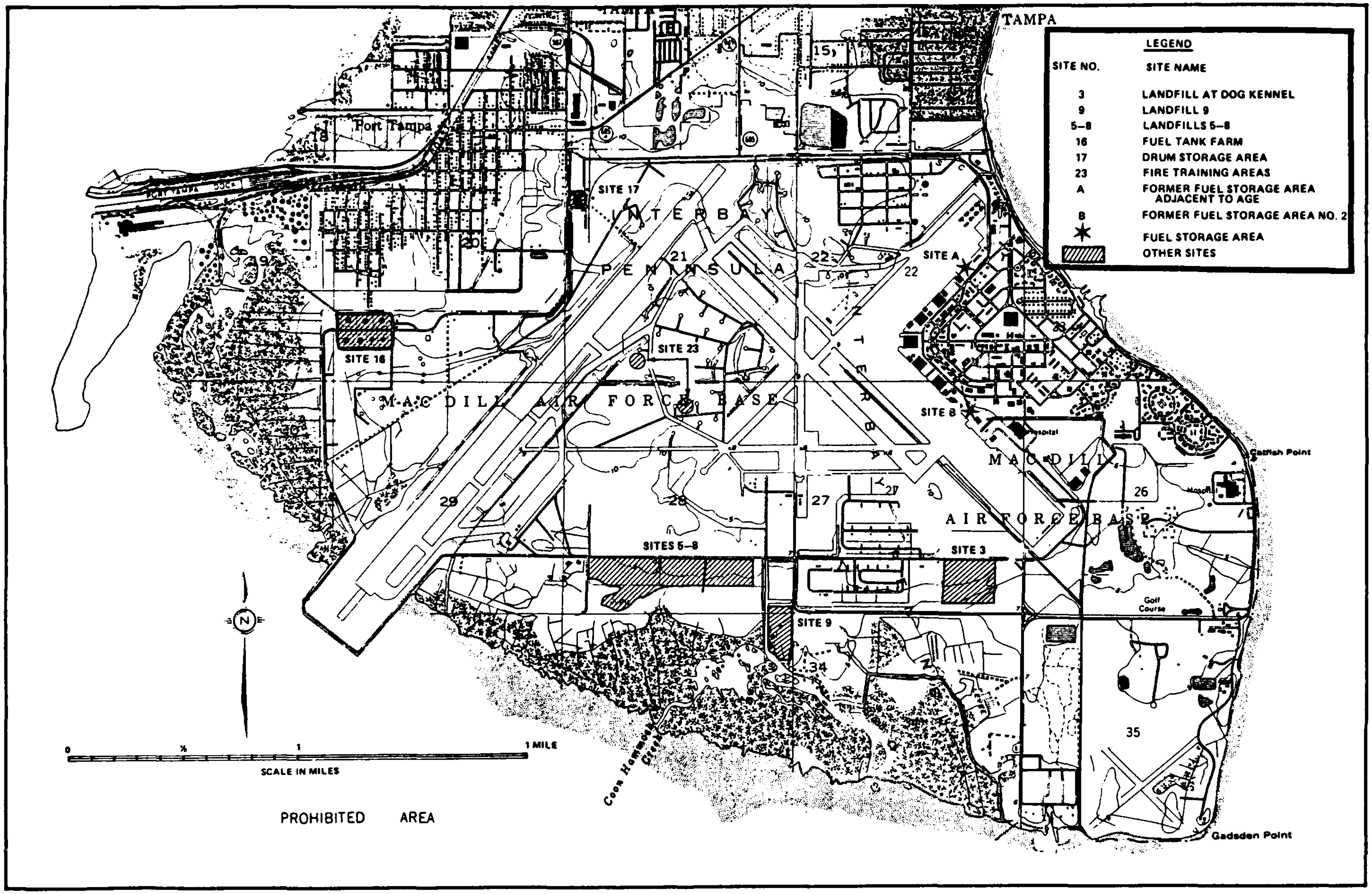
The U.S. Bureau of Prisons opened a minimum security prison camp on the base in 1951. Today it is the State of Florida's Avon Park Correctional Institution.

In 1956, the base (now called the Avon Park Auxiliary Airfield) was merged with the range and assigned to SAC at MacDill AFB. In 1962, the range was reassigned to TAC.

The 56th Tactical Fighter Wing at MacDill AFB is responsible for operation and maintenance of the Avon Park AFR. The mission of the Avon Park AFR is to provide support and maintenance of AFR facilities for bombing, strafing, and electronic warfare training of aircrews. The AFR is used for bombing practice by USAF units from throughout the Southeast and by Reserve and National Guard units for artillery firing, parachute jump training, and ground exercises.

1.3 STUDY AREA DESCRIPTIONS

A wide variety of sites were considered in the Phase IIb study for MacDill AFB and Avon Park AFR; they included five landfills, two fuel storage areas, two fire training areas, one transformer and drum storage area, and one pesticide rinse water basin. Five of the sites are at MacDill AFB (Figure 2 and Table 1), and three are at Avon Park AFR (Figure 3 and Table 1).



SOURCE: U. S. Geological Survey, 1969. Port Tampa, Florida (7.5' Topographic Map).
U. S. Geological Survey, 1972. Gibsonton, Florida (7.5' Topographic Map).

FIGURE 2. Phase II Installation Restoration Program Study Areas at MacDill AFB, Florida

Table 1. Phase II Field Evaluation Study Sites at MacDill AFB and Avon Park AFR, Florida (Page 1 of 2)

Site No.	Site Name	Period of Operation	Suspected Types of Waste
MacDill AFB			
16	Fuel Tank Farm--MacDill AFB	1952-Present	Fuel and avgas sludge containing teraethyl lead.
[illegible]	Landfill at Dog Kennel	1950-1959	Paint cans, solvents, garbage, PCB-containing capacitors, waste oil, battery casings, empty pesticide and herbicide containers, tires, adhesives, and construction debris.
5-8	Landfills 5-8 Past Landfills	1959-1973	Paint cans, solvents, garbage, PCB-containing capacitors, waste oil, battery casings, empty pesticide and herbicide containers, tires, adhesives, construction debris, sewage treatment plant sludge, and avgas sludge containing tetraethyl lead.
9	Landfill 9 Current Landfill	1974-1981	Paint cans, solvents, garbage, PCB-containing capacitors, waste oil, battery casings, empty pesticide and herbicide containers, tires, adhesives, construction debris, sewage treatment plant sludge, and avgas sludge containing tetraethyl lead.
A	Former fuel storage area adjacent to AGE--MacDill AFB	1940s to late 1950s	Fuel. Not described in Phase I report.

Table 1. Phase II Field Evaluation Study Sites at MacDill AFB and Avon Park AFR, Florida (Page 2 of 2)

Site No.	Site Name	Period of Operation	Suspected Types of Wastes
17	Drum storage area--MacDill AFB	1950-1981	Storage of PCB-containing transformers and temporary storage of drums containing waste oils, solvents, and paint. Used for weathering of avgas sludge between 1965 and 1973.
23	Fire training areas--MacDill AFB	1955-Present	Waste fuel, oil, and solvents.
Avon Park AFR			
AP6	Old landfill--Avon Park AFR	1950-1978	Solid waste.
AP7	Current sanitary landfill--Avon Park AFR	1978-Present	Solid waste.
AP11	Pesticide rinse water basin	Not reported	Rinse water from pesticide containers.

Source: Moccia et al., 1981.

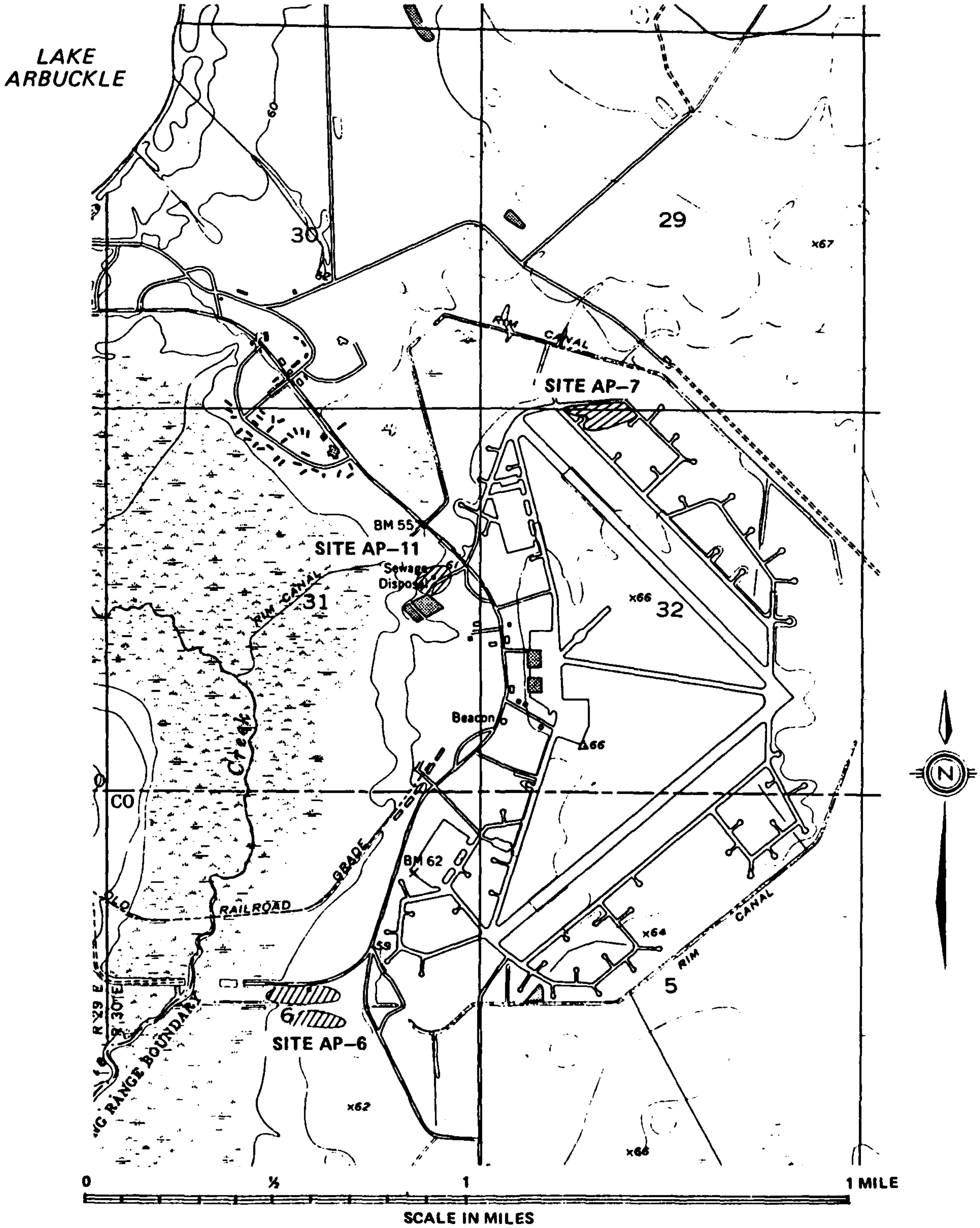


FIGURE 3. Phase II Installation Restoration Program Study Areas at Avon Park AFR, Florida

BASE MAP: U. S. Geological Survey. 1972.
Lake Arbuckle NE, Florida. (7.5' Topographic Map).

1.3.1 <u>MacDill AFB</u>

1.3.1.1 <u>Site 16, Fuel Tank Farm</u>--This area, near the western boundary of MacDill (Figures 2 and 4), has been in use since 1952 and consists of seven aboveground storage tanks. Site 16 received the highest hazard rating in the Phase I report and was described as a "possible fuel-saturated area". Moccia <u>et al</u>. (1981) also stated that aviation gasoline (avgas) sludge containing tetraethyl lead was reportedly buried within the earth levees around the tanks. This site is drained by ditches (Figure 4) which direct runoff south toward Tampa Bay.

1.3.1.2 <u>Landfill 3, Landfill at Dog Kennel</u>--This landfill was in use from 1950 to 1959 (Moccia <u>et al</u>., 1981) and is east of the munitions storage area (Figures 2 and 5). Landfill 3 is drained by several ditches which flow west toward Broad Creek, a channel in the mangrove swamp on the south side of MacDill AFB. Part of the area of Landfill 3 is now used as a spray irrigation field for effluent from the sewage treatment plant; three other spray irrigation fields are nearby (Figure 5).

1.3.1.3 <u>Landfills 5-8</u>--These four landfills are on the south side of the base between Southshore Road and the mangrove swamp (Figures 2 and 6) and were in use from 1959 to 1974. Several ditches drain the area of these landfills toward Broad Creek which flows into Tampa Bay.

1.3.1.4 <u>Landfill 9</u>--Landfill 9 was the active landfill from the closure of Landfill 8 (1974) to the time of the Phase I report (1981) (Table 1); therefore it was referred to as Present Landfill in the Phase I report. Since it is now closed, it is referred to as Landfill 9 in this report. Surface drainage for Landfill 9 is toward Broad Creek which borders the north, west, and south sides of the landfill (Figures 2 and 7).

1.3.1.5 <u>Site A, Former Fuel Storage Area Adjacent to AGE</u>--Site A, located in the flight line area (Figures 2 and 8), was not described in the Phase I report. It was included in the present study because an excavation in the vicinity encountered a layer of oil or fuel on top of

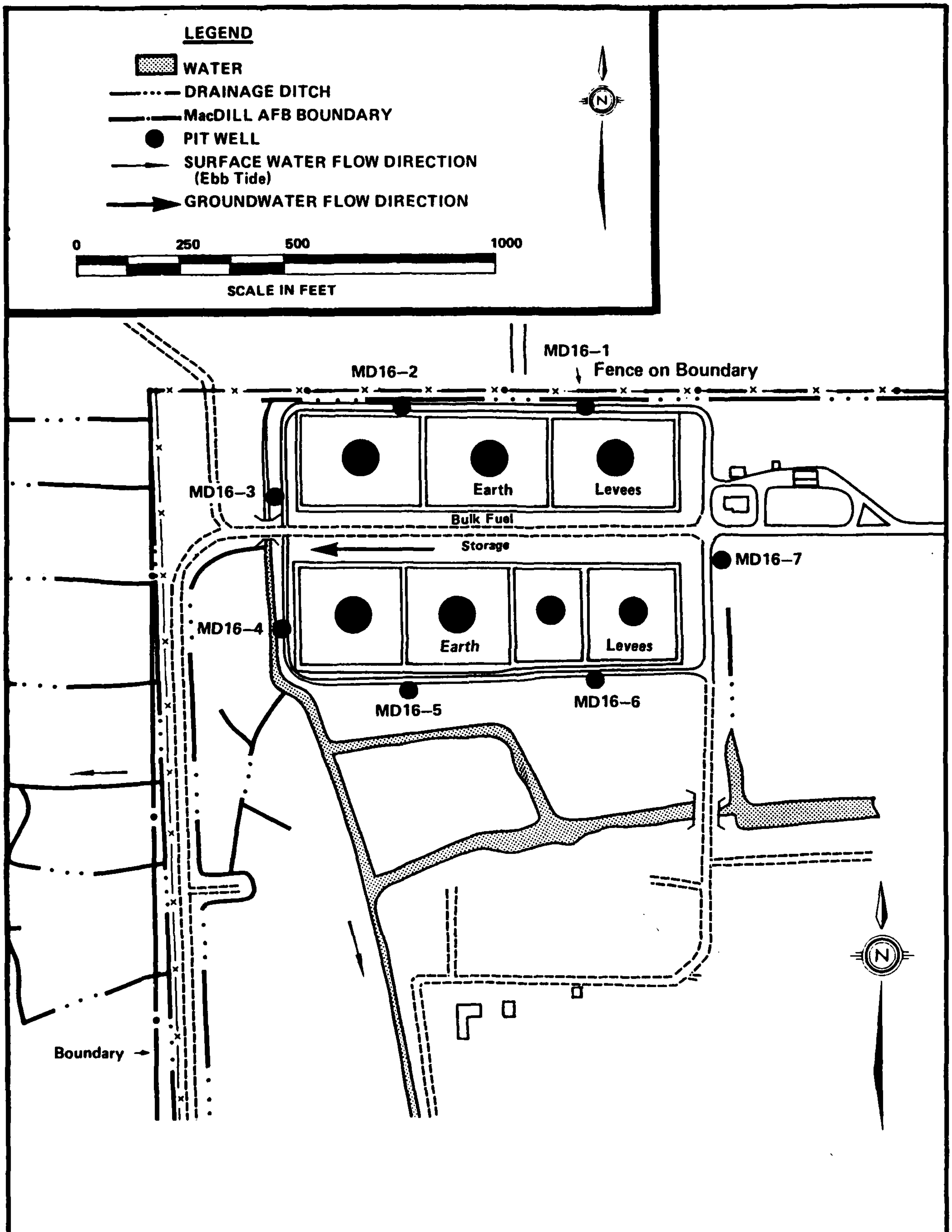


FIGURE 4. Sample Stations at Site 16, Fuel Tank Farm, MacDill AFB, November 1983

BASE MAP: MacDill AFB, Tab No. G–7, Sheet 4.

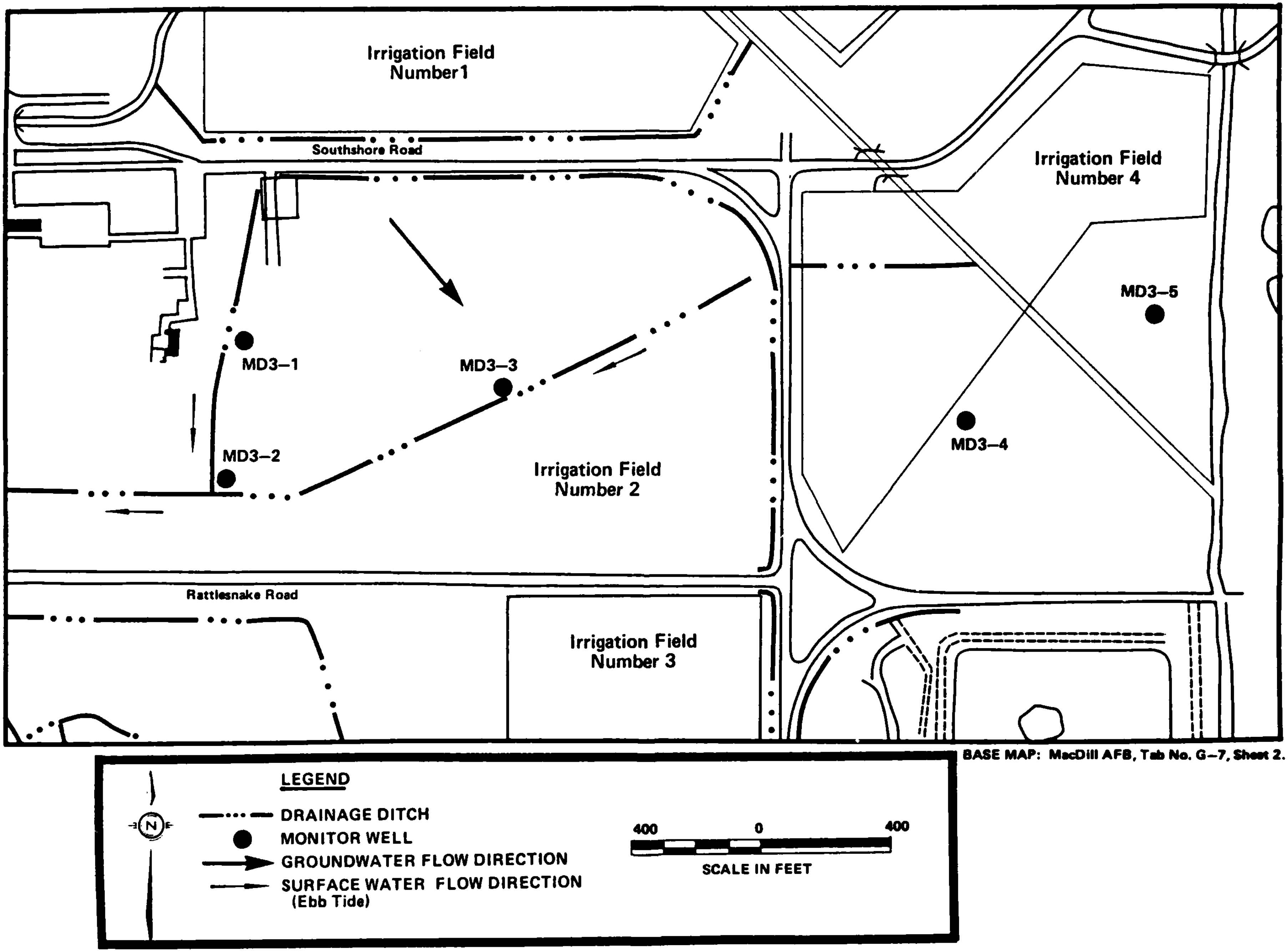


FIGURE 5. Sample Stations at Landfill 3, Landfill by Dog Kennel, MacDill AFB, November 1983

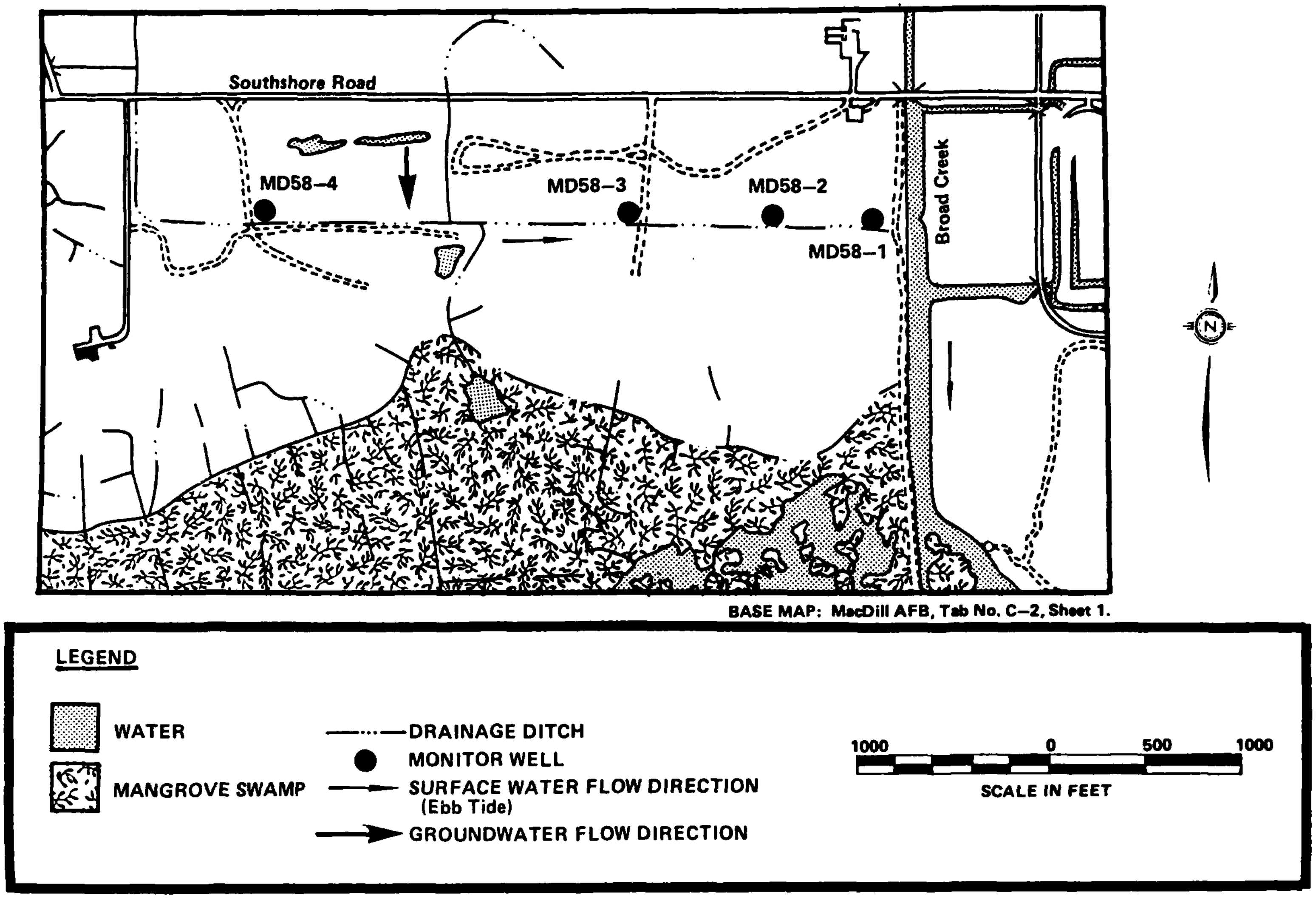


FIGURE 6. Sample Stations at Landfills 5–8, MacDill AFB, November 1983

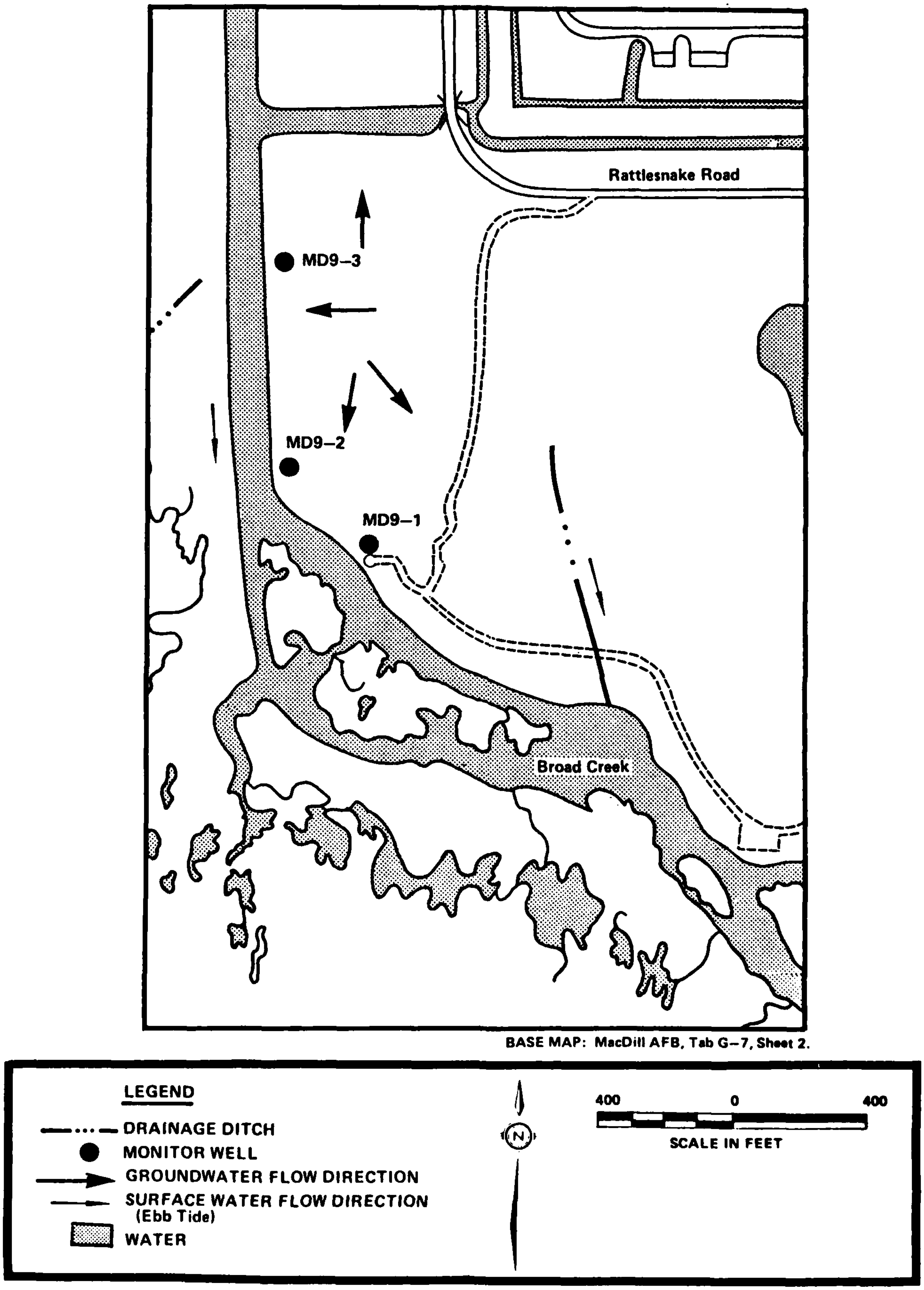
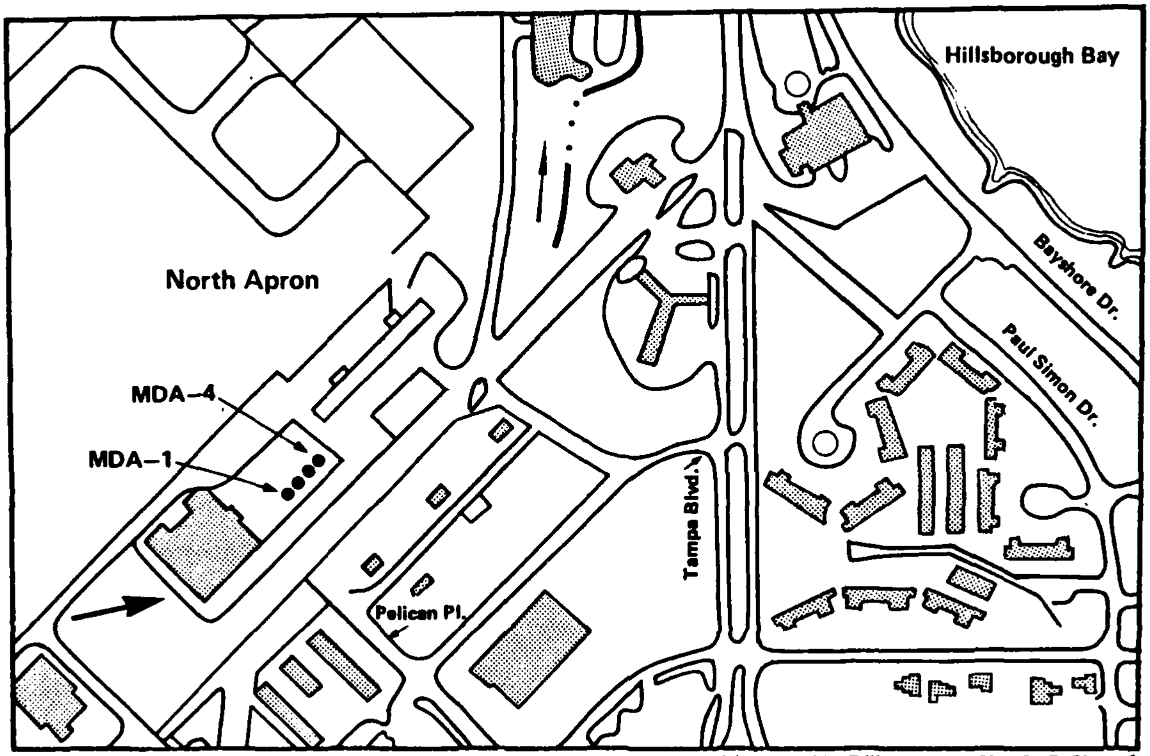


FIGURE 7. Sample Stations at Landfill 9, MacDill AFB, November 1983



BASE MAP: MacDill AFB, Tab No. G-7, Sheet 1.

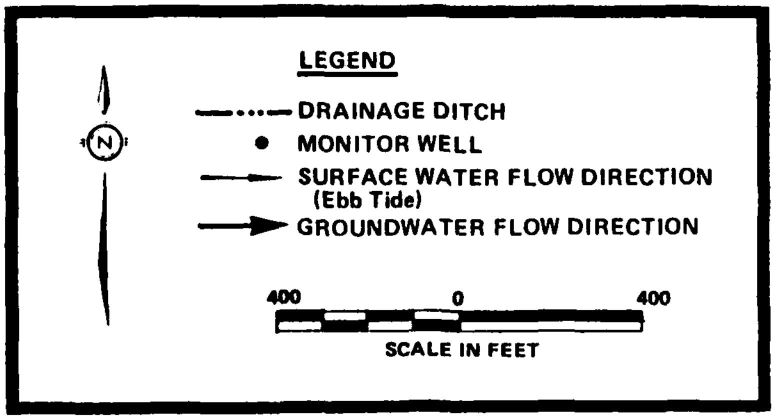


FIGURE 8. Sample Stations at Site A, Former Fuel Storage Area Adjacent to AGE, MacDill AFB, November 1983

the groundwater. The suspected source of this contamination was a fuel storage area consisting of eight 25,000-gallon underground tanks (Newberry, 1984). These tanks stored avgas and were taken out of service when MacDill AFB transitioned to jet aircraft.

1.3.1.6 Site 17, Drum Storage Area--This site consists of a concrete pad near the northwest corner of MacDill AFB (Figures 2 and 9). It was used for storage of out-of-service transformers containing PCBs and for the temporary storage of drums containing various waste materials. It was also used for the weathering of avgas sludge from 1965 to 1973. Surface drainage from this site is provided by a small ditch which flows south toward Tampa Bay.

1.3.1.7 Site 23, Fire Training Area--Site 23 consists of two unlined pits in the middle of the airfield (Figures 2 and 10). One pit (to the northwest) is still used; however, the southeastern pit is no longer used. Fire training activities in the past consisted of pouring waste fuels, oils, and solvents into the pit, igniting them, and then extinguishing the fire. At present, only uncontaminated fuel is used for fire training.

1.3.2 Avon Park AFR

1.3.2.1 Landfill AP6, Old Landfill--This landfill is in the southwest portion of the auxiliary airfield at Avon Park AFR (Figures 3 and 11). It is bisected by a drainage ditch which flows west toward Arbuckle Creek.

1.3.2.2 Landfill AP7, Current Sanitary Landfill--This landfill has been in use since 1978. It is located within a taxiway loop on the north side of the Avon Park AFR airport (Figures 3 and 11).

1.3.2.3 Site AP11, Pesticide Rinse Water Basin--Pesticide containers are rinsed with water at this site which consists of a concrete-lined

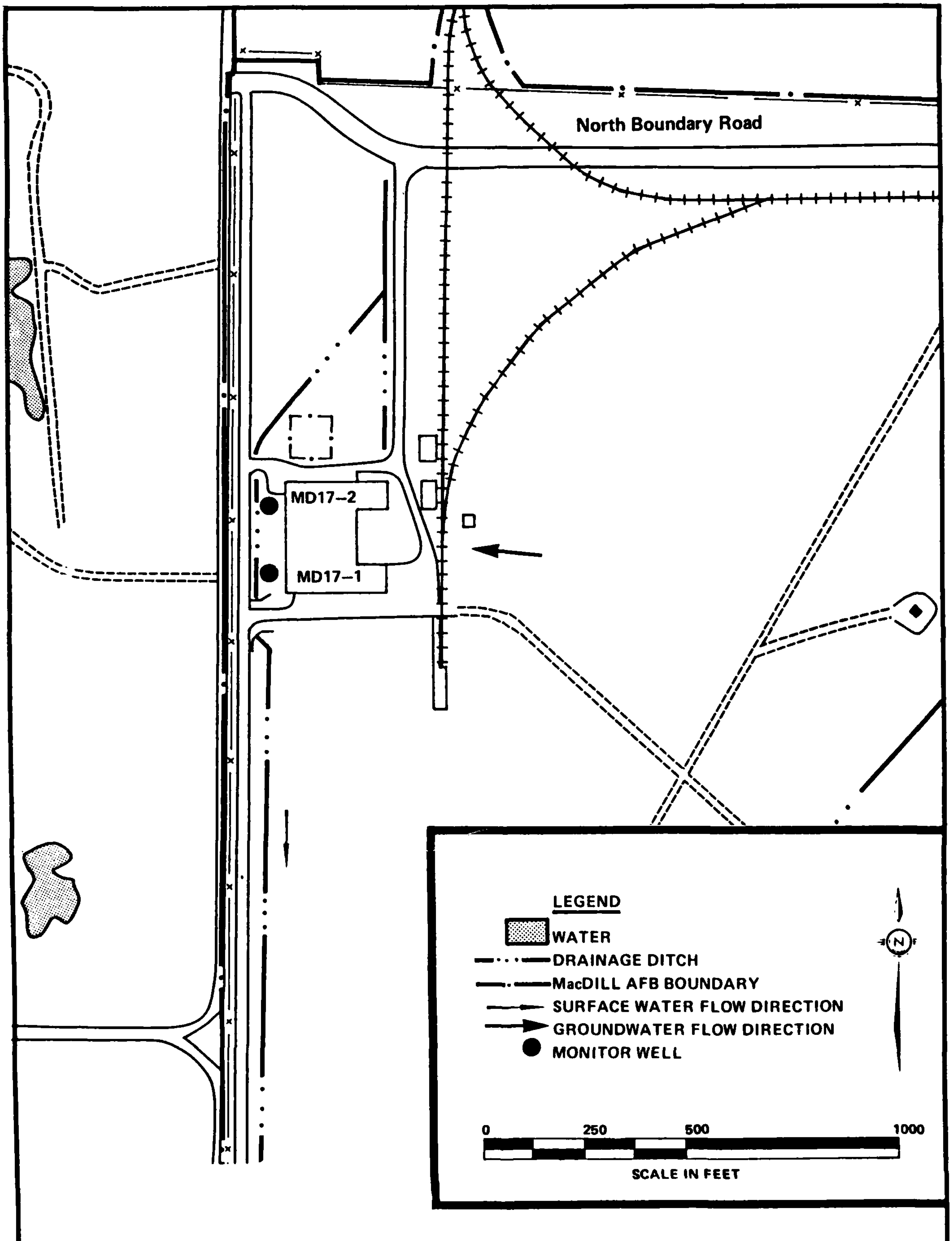


FIGURE 9. Sample Stations at Site 17, Drum Storage Area, MacDill AFB, November 1983

BASE MAP: MacDill AFB, Tab G-7, Sheet 4

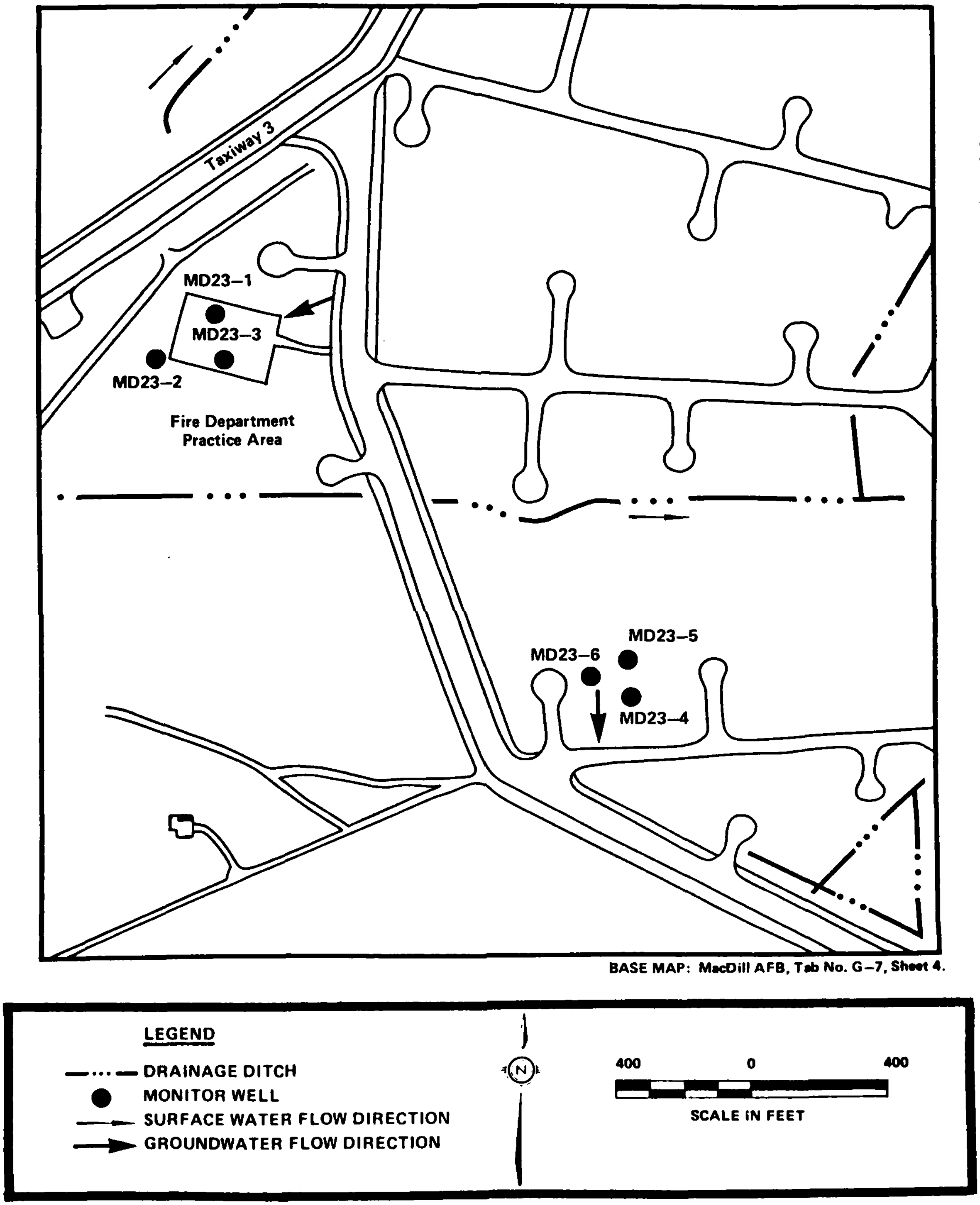


FIGURE 10. Sample Stations at Site 23, Fire Training Areas, MacDill AFB, November 1983

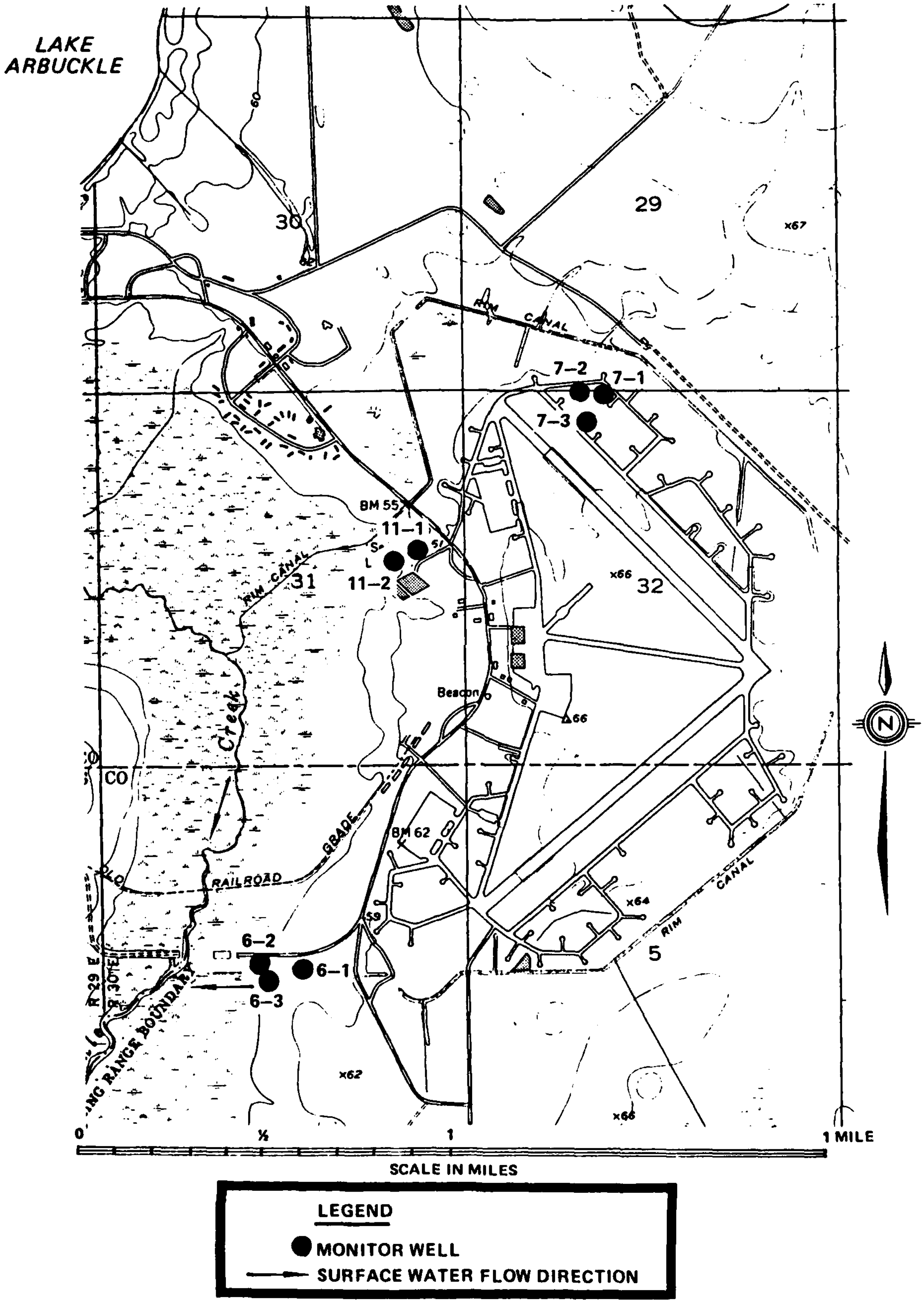


FIGURE 11. Sample Stations at Avon Park AFR, November 1983

BASE MAP: U. S. Geological Survey. 1972. Lake Arbuckle NE, Florida. (7.5' Topographic Map).

1.4 PROJECT STAFF

WAR's project staff consists of the following people whose resumes are included as Appendix H:

- W.D. Adams, M.S.--Project Manager, Hydrogeologist
- J.H. Sullivan, Ph.D., P.E.--Environmental Engineer
- W.G. Thiess, M.S.--Environmental Engineer
- C.R. Fellows, M.S.--Chemist
- R.D. Baker, B.S.--Chemist
- J.A. Steinberg, Ph.D., P.E.--Water Resource Engineer

2.0 ENVIRONMENTAL SETTING

2.0 ENVIRONMENTAL SETTING

The following discussion of the climate, geology, and hydrology of MacDill AFB and the Avon Park AFR was reproduced from the Phase I report (Moccia et al., 1981) with minor editing for consistent format, updated terminology, and improved clarity.

2.1 MACDILL AFB

2.1.1 Meteorological Data

The climate in the vicinity of MacDill AFB is subtropical, with short, mild winters and long, hot summers. Major geographic features affecting the climate at MacDill AFB are the Gulf of Mexico, the Caribbean Sea, and the Atlantic Ocean.

The annual average temperature at the base is 72°F (22°C), with an average daily maximum and minimum of 82°F and 63°F (28°C and 17°C), respectively (see Table 2). Average monthly temperatures range from 60°F (16°C) in January to 82°F (28°C) in August. The Gulf of Mexico contributes to mild winters in the area and is responsible for high relative humidities. Monthly averages range from 50 to 90 percent relative humidity.

Average annual precipitation at MacDill AFB is 44.3 inches, (1,125 millimeters) almost 60 percent of which falls during the rainy season from mid-June to mid-September. Spring and fall are drier seasons, with slightly higher precipitation in the winter months. The average lake evaporation rate is approximately 50 inches (1,270 millimeters) per year. Actual evapotranspiration is less than this and is dependent on vegetative cover. Summer thunderstorms occur an average of 91 days each year, more than any other area of the United States. These storms have a significant cooling effect, with a typical thunderstorm causing temperatures to drop from the low 90's to the low 70's°F (30's to 20's°C) on summer afternoons.

Table 2. Meteorological Data for MacDill AFB*

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°F)													
Average Daily Max.	70	71	75	81	86	89	89	90	89	84	76	71	81
Average Daily Min.	52	54	59	64	70	74	75	76	75	68	59	54	65
Normal	61	62.5	67	72.5	78	81.5	82	83	82	76	67.5	62.5	73
Precipitation (inches)													
Normal	2.27	2.94	2.99	1.60	3.10	4.86	7.05	7.21	5.72	2.49	1.66	2.39	44.28

*Period of record: 1949-1980

Source: MacDill AFB, USAFETAC, Tab D, 4 April 1980 (Moccia et al., 1981).

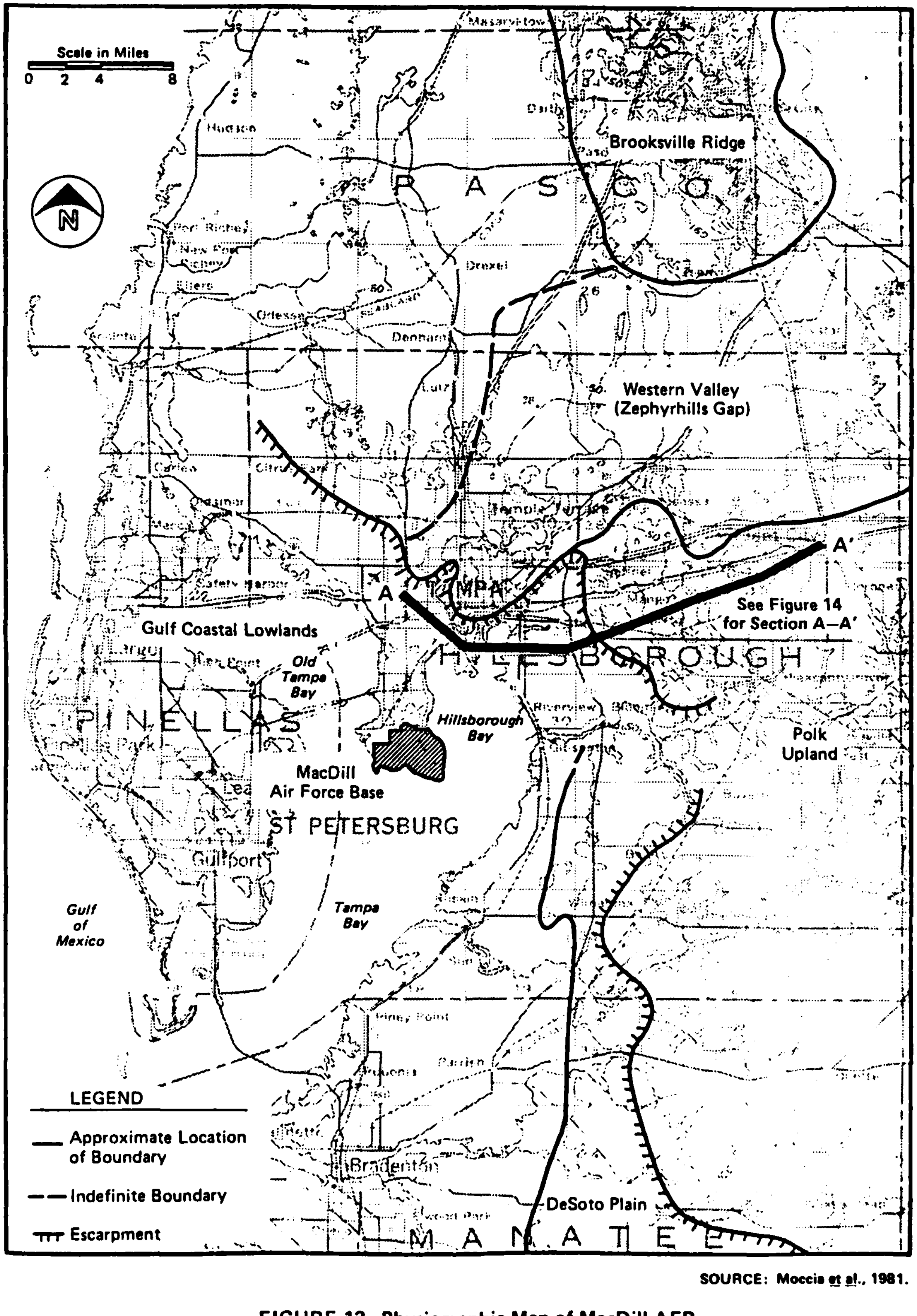
2.1.2 Geology

MacDill AFB is located at the southernmost tip of the Interbay Peninsula within the Middle Gulf Coastal Lowlands physiographic province. Figure 12 illustrates the major physiographic features in the vicinity of MacDill AFB.

Topography and relief at MacDill AFB are shown on Figure 13. Ground elevations are generally less than 10 feet (3 meters) above mean sea level (msl), with much of the base less than 5 feet (1.5 meters) above msl.

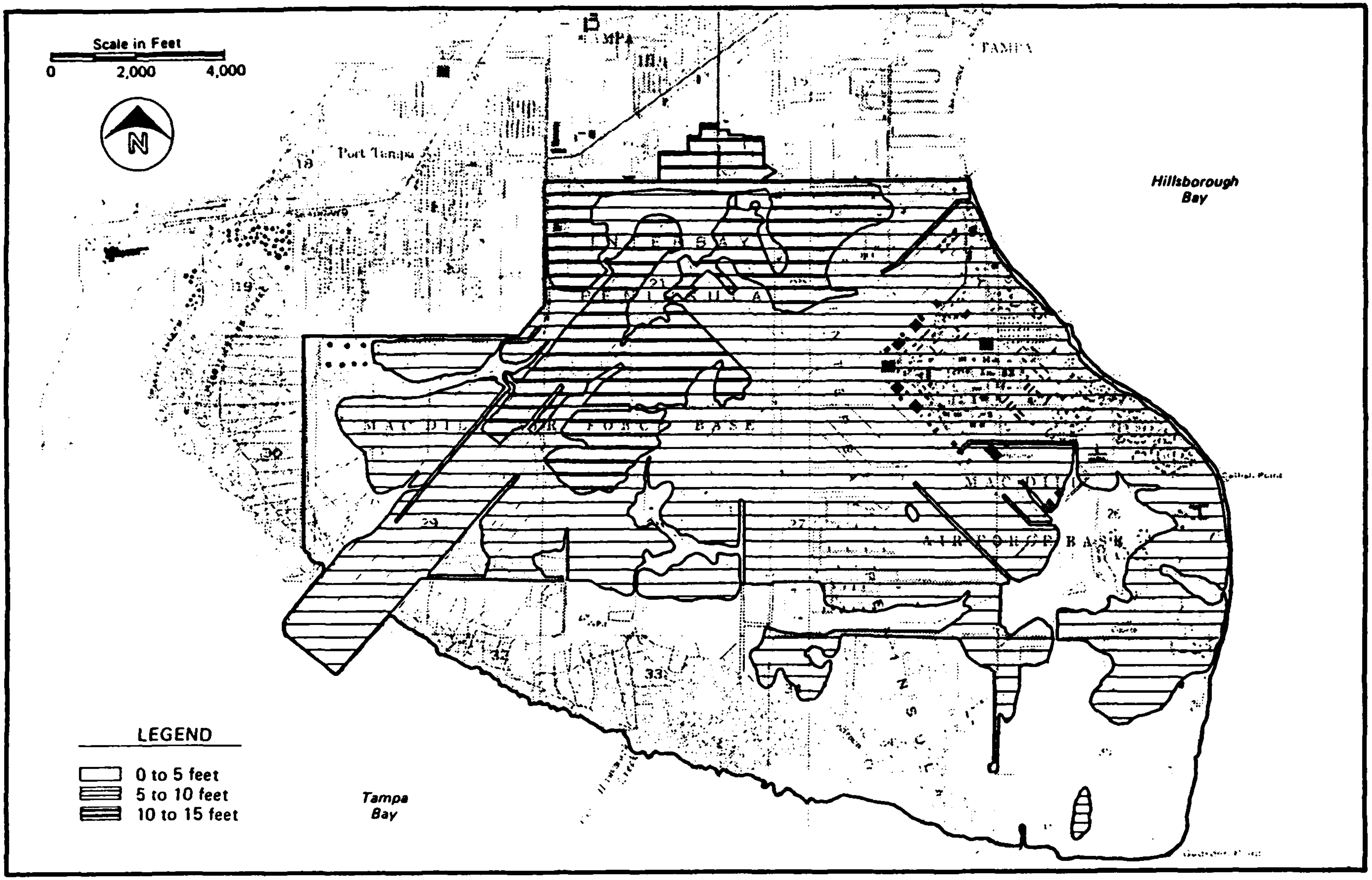
Surface deposits occurring at MacDill AFB consist of quartz sands which were deposited by Gulf and/or Bay currents and tides, and may contain some organically cemented horizons at various depths. As is typical of tide current deposition, this stratum has a variable thickness ranging from approximately 5 to 20 feet (1.5 to 6 meters). The horizontal hydraulic conductivity (hydraulic conductivity is equivalent to the term "coefficient of permeability" which was used in older texts and reports) of these sands is approximately 100 gallons per day per square foot (gpd/ft^2) (4.72 X 10^{-5} m/s). The vertical hydraulic conductivity in this type of formation is typically one-half the horizontal hydraulic conductivity due to the stratification of the deposit. Vertical hydraulic conductivity is therefore estimated at approximately 50 gpd/ft^2 (2.36 X 10^{-5} m/s).

Strata directly below the surface sands include clayey sand and sandy clay deposits with clay contents ranging from slightly less than 15 percent to over 50 percent. The higher the clay content of these strata the lower the hydraulic conductivity. A typical range of values for the hydraulic conductivity of the clayey sands is 0.021 to 9.8 gpd/ft^2 (9.91 X 10^{-9} to 4.63 X 10^{-6} m/s), whereas hydraulic conductivities for the sandy clays are typically around 0.001 gpd/ft^2 (4.72 X 10^{-10} m/s). This clayey layer forms the confining bed for the underlying artesian aquifer. The thickness of this stratu[illegible]nges from 2 to 20 feet (0.7 to 6 meters) at MacDill AFB.



SOURCE: Moccia et al., 1981.

FIGURE 12. Physiographic Map of MacDill AFB



SOURCE: Moccia et al., 1981.

FIGURE 13. Topographic Map of MacDill AFB

Directly below this stratum of lower hydraulic conductivity is the upper unit of the Floridan Aquifer, referred to as the Tampa Limestone. This unit consists of a gray or light tan to white limestone, which is usually sandy, fossiliferous in places, and commonly contains clay lenses and cavities. The limestone is generally dense and hard, especially where sandy, but may be soft in places where badly weathered. Commonly, the upper surface of the limestone is "case hardened" by impregnation with silicon dioxide derived from overlying sands (quartz sand is composed of silicon dioxide).

Hydraulic conductivity of the Tampa Limestone is greatly dependent on the degree of solution, variations in lithology, and the occurrence of clay lenses. The hydraulic conductivity of the rock itself is very low, ranging from 0.1 to 15 gpd/ft^2 (4.72 X 10^{-8} to 7.08 X 10^{-6} m/s); however, due to solution of the limestone, a secondary porosity has developed along enlarged bedding planes, fractures, and joints. This greatly increases the hydraulic conductivity of the in-place formation as a whole compared to the rock itself. The Tampa Limestone formation has a hydraulic conductivity on the order of 1,000 gpd/ft^2 (4.72 X 10^{-4} m/s).

The Tampa Limestone marks the top of a thick sequence of carbonate rock consisting of limestone and dolomite which occurs to a depth of approximately 10,000 feet (3,050 meters) below land surface. The hydraulic conductivity of each carbonate stratum is also dependent on the lithology and degree of solution. Generally, the deeper layers do not contain clay. As with the Tampa Limestone, secondary porosity along joints, fractures and bedding planes, and at erosion surfaces between formations is much more important than the porosity of the rock itself. Hydraulic conductivities within some sections of the limestone are extremely high, exceeding 500,000 gpd/ft^2 (2.36 X 10^{-1} m/s).

These carbonate strata, together with the Tampa Limestone, make up the principal artesian aquifer in this area, providing water supply to the

surrounding communities, irrigation, and mining. Table 3 summarizes the geologic formations occurring beneath MacDill AFB, including names and descriptions of each formation and their use as water supply sources.

Below the carbonate rock at MacDill AFB there is a hard, dense crystalline rock referred to as the Basement Rock. Its presence is known from oil test wells, and it occurs at approximately 10,000 feet (3,050 meters) below land surface. The formation's physical properties are not precisely known since drilling ceases when this stratum is encountered. Figure 14 illustrates a typical geological cross-section in the MacDill AFB vicinity.

2.1.3 Hydrology

MacDill AFB is located within an ill-defined lowland referred to as the "Coastal Streams" drainage basin. As the name implies, this basin is drained by a series of small shallow streams which flow directly toward the bays. Since the base is located at the tip of a peninsula, rainwater falling on the base runs off in three directions toward the surrounding water bodies. Runoff rates are quite low due to the lack of both elevation and relief. Drainage modifications, including canals and storm drainage systems, have aided in stormwater removal from streets and runways.

Surface water hydrologic conditions at MacDill AFB are primarily controlled by storm drainage systems and small tidal streams. There are no major rivers or streams which enter or leave MacDill AFB. Broad Creek and Coon Hammock Creek, occurring within the mangrove swamp on the south side of the base, are the only surface water features of any significance on the base. These creeks are actually tidal inlets rather than streams and receive some runoff from the south side of the base as illustrated on Figure 15. The only other significant surface water hydrologic feature is the base storm drainage system, which discharges to both Hillsborough and Tampa Bays.

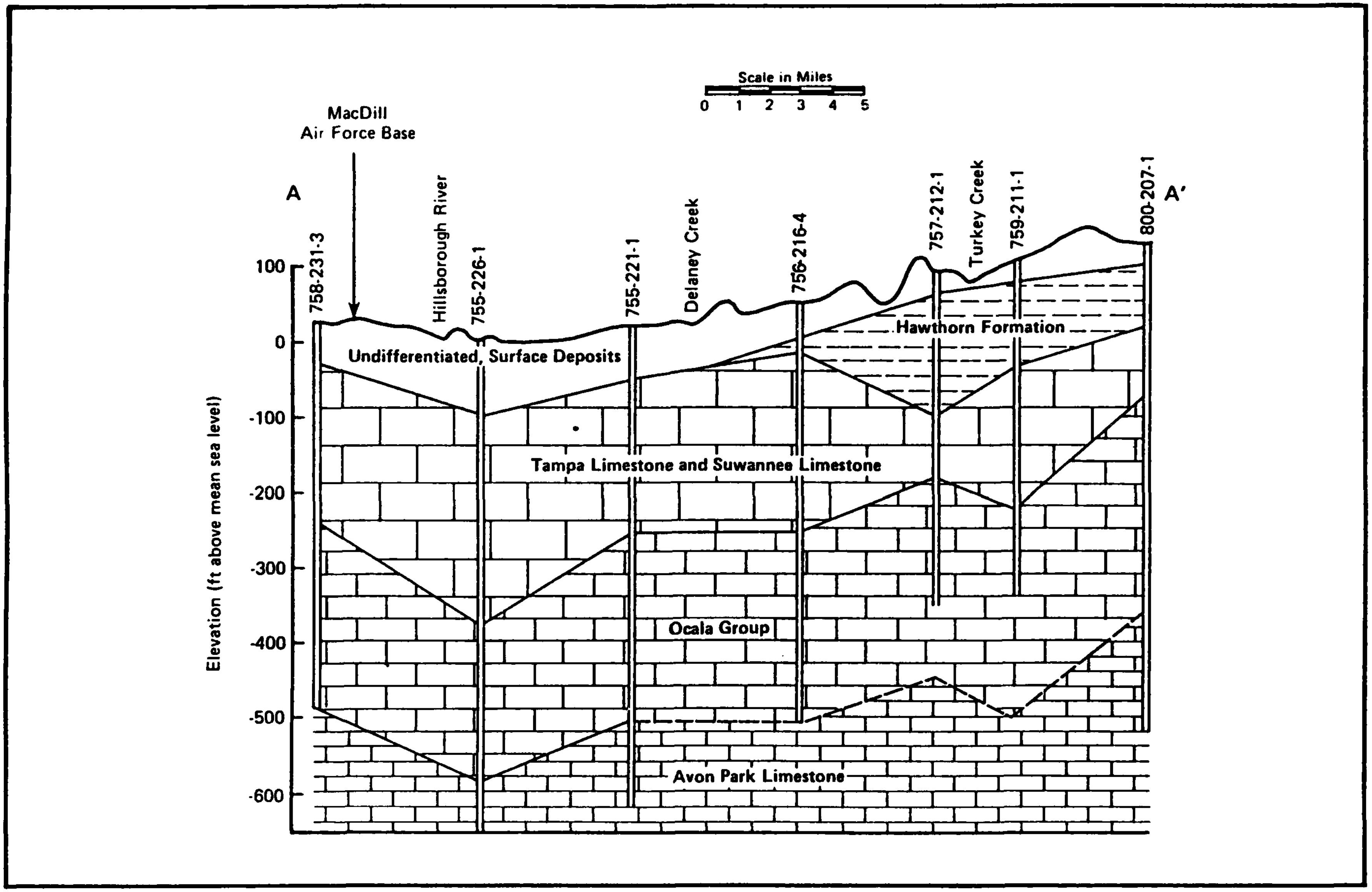
Table 3. Summary of Geologic Formations in the Vicinity of MacDill AFB (Page 1 of 2)

Series	Formation	Thickness	Character of Material	Water Supply	Aquifer	Water Level
Pleistocene and Recent Piocene	Undifferentiated	0-150	Sand, clay, and marl.	Sand yields up to 200 gpm in some areas and generally 5 to 10 gpm to wells less than 40 feet deep. Clay and marl do not yield usable quantities of water to wells.	Water table	Water level generally less than 10 feet. Water table follows topography in a subdued manner.
Miocene	Hawthorne formation	0-250	Clay, sand, and limestone. Limestone, near bottom of formation, is white to gray, soft, sandy, and porous.	Limestone member yields up to 200 gpm.	Shallow artesian aquifer	Potentiometric surface not defined. Water level is generally higher than that of nearby wells in principal artesian aquifer.
	Tampa limestone	80-400	White, cream, and gray, hard to soft, sandy limestone. Many molds of pelecypods and gastropods.	Yields up to 1,000 gpm. Supplies most domestic and commerical wells in county.	Principal artesian (Floridan)	
Oligocene	Suwannee limestone		White, yellow, and light brown, soft to hard, dense, fine-grained limestone with chert lenses to 25 feet thick.			

Table 3. Summary of Geologic Formations in the Vicinity of MacDill AFB (Page 2 of 2)

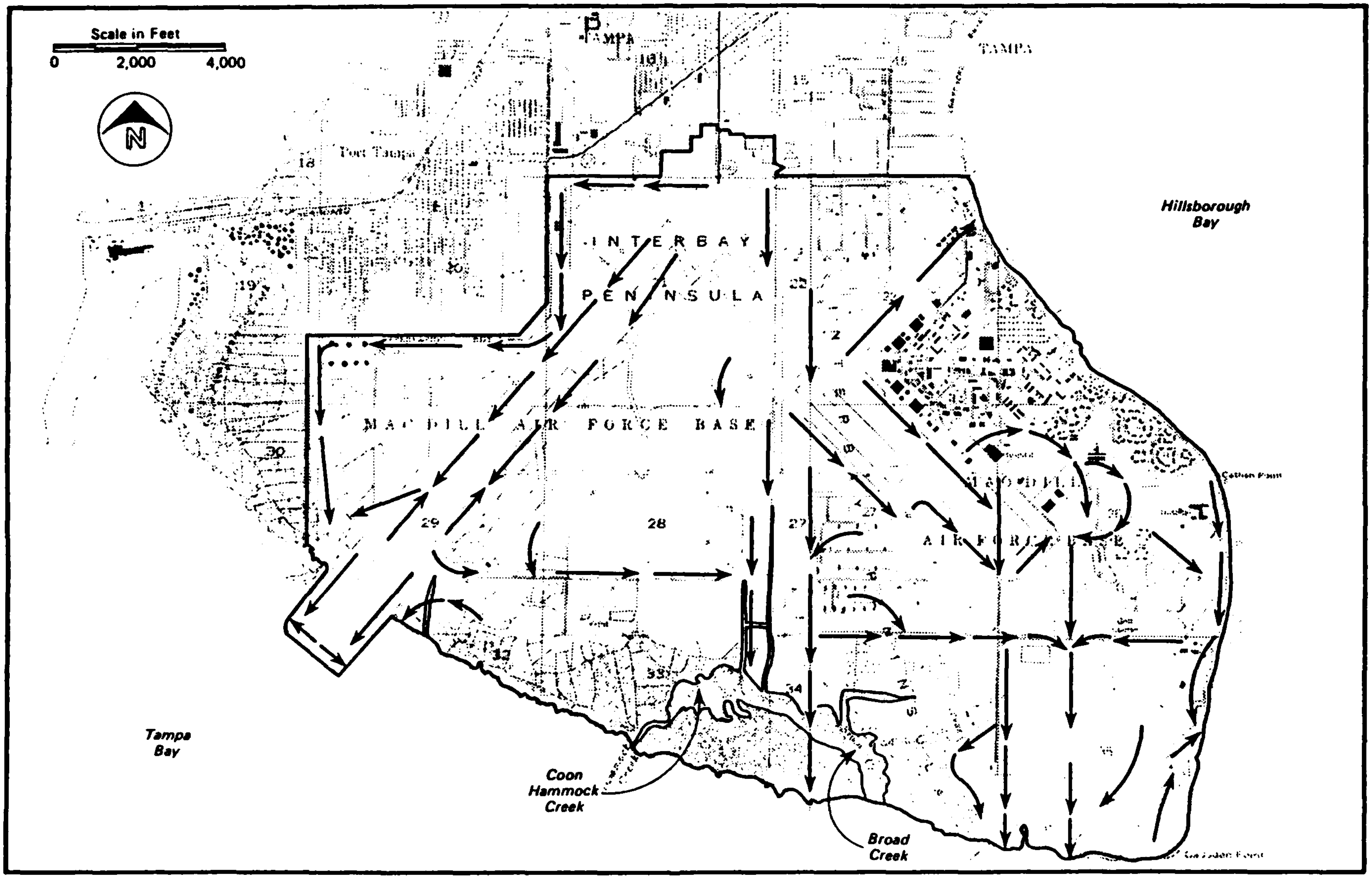
Series	Formation	Thickness	Character of Material	Water Supply	Aquifer	Water Level
	Ocala Group: Crystal River formation (Puri, 1957) Williston formation (Puri, 1957) Inglis limestone	90-300	Yellow-gray and brown soft, almost pure limestone. Mostly foraminiferal coquinas in pasty limestone matrix.	Rarely used for water supply because of low transmissibility.		
Eocene	Avon Park limestone	200+	Soft, chalky, cream to brown limestone containing beds of foraminiferal coquina and zones of brown to dark brown, hard, crystalline dolomitic limestone. Locally contains some gypsum.	Principal source of supply for wells yielding more than 500 gpm. Yield exceeds 5,000 gpm in some wells.	Principal artesian (Floridan)	Potentiometric surface shown on Figure 2-5.
	Lake City limestone	500				
	Oldsmar limestone	900	Fragmental dolomitic limestone with lenses of chert, thin shale beds, and some gypsum.	Not used for water supplies but is potential source of fresh water in north central and northeastern part of county.		
Paleocene	Cedar Keys limestone	Not known	Not known.	Not used. Potential use not known.		

Source: Moccia et al., 1981.



SOURCE: Moccia *et al.*, 1981.

FIGURE 14. Geologic Cross-Section of Hillsborough County (East–West Trend)



SOURCE: Moccia et al., 1981.

FIGURE 15. Surface Drainage Map of MacDill AFB

Groundwater occurs within two aquifer systems at MacDill AFB. Within the upper sands and clayey sands, groundwater occurs under water table conditions at a depth of about 1 to 4 feet (0.3 to 1.2 meters). Groundwater levels in this aquifer rise and fall freely in response to rainfall and evapotranspiration. Within the deeper limestone strata, the Floridan Aquifer, groundwater occurs under artesian or leaky artesian conditions (i.e., groundwater levels do not respond as freely to local recharge or evapotranspiration). The two aquifer systems are separated by strata of low hydraulic conductivity, usually clay or sandy clay.

Recharge to the water table aquifer is provided by direct rainfall infiltration which permeates the upper unsaturated sand. Once the recharge reaches the water table, it will move laterally downgradient toward the bays in the same direction as the surface drainage shown on Figure 15. This lateral movement is very slow, however, because of the low hydraulic gradient.

The water table aquifer is not used as a potable water source, although water within the aquifer is generally fresh. At the periphery of the base adjacent to the bays, natural water quality is degraded by the influence of salt water. Pollutant contamination of the water table aquifer at waste disposal sites would be immediate, since recharge to the aquifer is direct from rainfall. Eventually, contaminants could enter either Hillsborough or Tampa Bays. There is a potential, therefore, for contaminant migration to surface waters.

Water quality within the upper Floridan Aquifer at MacDill AFB is somewhat high in chloride concentration and total dissolved solids (TDS). Due to its proximity to salt water, there are no large withdrawals of groundwater from the Floridan Aquifer at or near MacDill AFB. There is a lens of fresh water of very limited extent occurring in the upper 50 feet (15 meters) of the Tampa Limestone, but this is not developable as a water supply source. Fresh, potable water is obtained by MacDill AFB

from the city of Tampa. No potable water supplies are generated on the base.

Recharge to the Floridan Aquifer is a function of water levels in the water table aquifer, the potentiometric surface of the Floridan Aquifer, and the vertical hydraulic conductivity and thickness of the confining unit separating the two aquifers. Where the water table is higher than the potentiometric surface, water will flow from the water table aquifer to the Floridan Aquifer; the reverse is also true. The rate of recharge may be determined according to the following relationship:

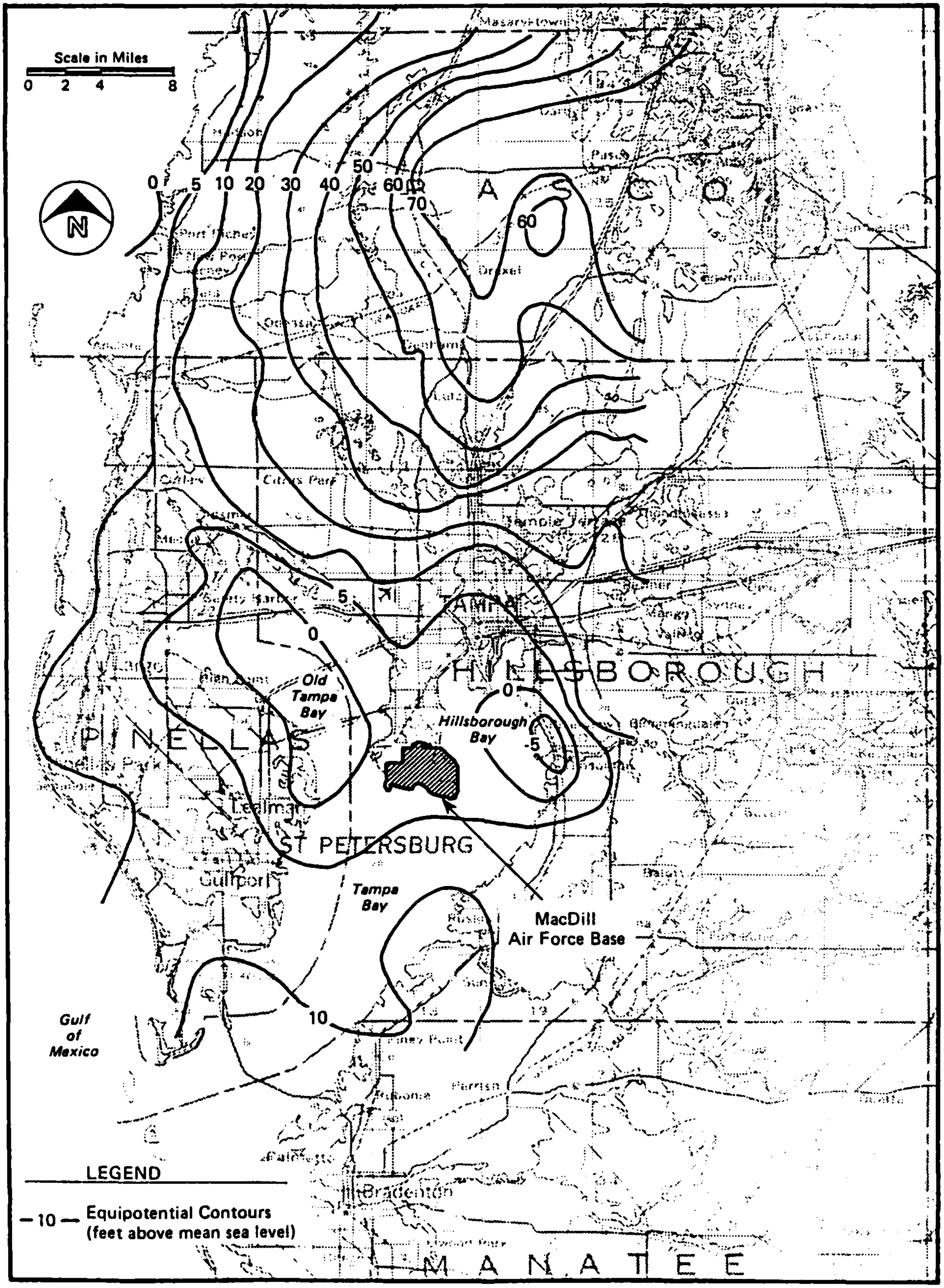
$$q = K\frac{dh}{dl} \text{ where}$$

q = recharge rate,
dh = head difference between the two aquifers,
dl = thickness of the confining unit, and
K = vertical hydraulic conductivity of the confining unit.

Figure 16 shows that the potentiometric surface of the Floridan Aquifer at MacDill AFB is less than 5 feet above msl. Figure 17 shows that the water table is as high as 7 feet above msl; therefore, the Floridan Aquifer receives recharge from the water table aquifer in at least some portions of MacDill AFB. In an evaluation of recharge to the Floridan Aquifer in Florida, Stewart (1980) mapped MacDill AFB as an area of very low to moderate recharge (2 to 10 inches of rainfall per year) to the Floridan Aquifer. This recharge accounts for the fresh water in the upper 50 feet (15 meters) of the upper unit of the Floridan Aquifer.

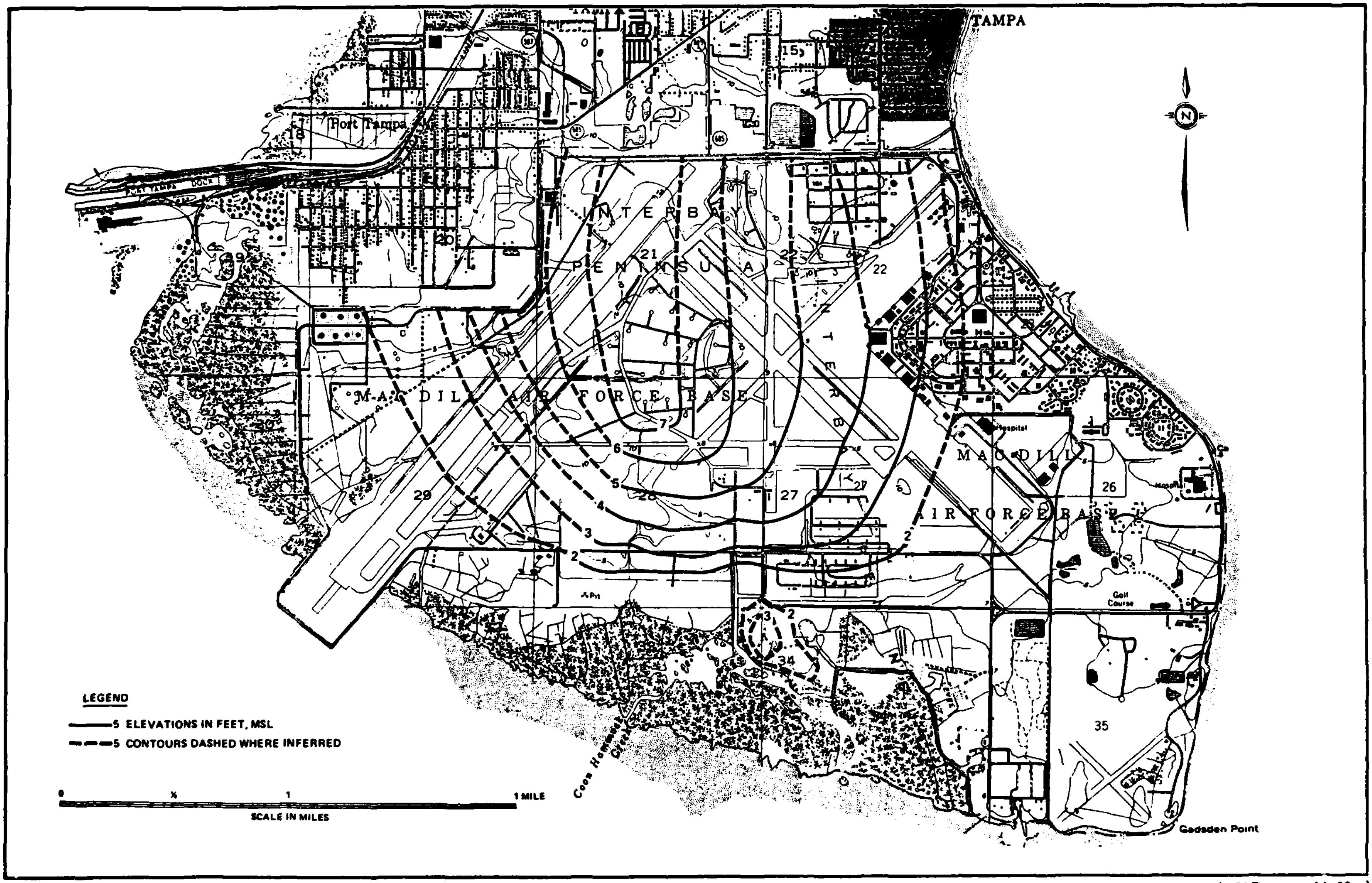
2.2 AVON PARK AFR

Avon Park AFR is located within the Highlands Ridge and Eastern Flatland physiographic provinces situated west of the Kissimmee River. The Highlands or Lake Wales Ridge region includes a narrow, elongated area of rolling uplands with numerous hills and lakes. Elevations range from 40 to 200 feet (10 to 60 meters) above msl. Most of the lakes are deep and circular and were created by sinkhole formation. The Eastern Flatlands region consists of flat areas bounded by the ridge on the west, extending



SOURCE: Moccia et al., 1981.

FIGURE 16. Potentiometric Surface of the Floridan Aquifer, May 1979



BASE MAP: U. S. Geological Survey, 1969. Port Tampa, Florida (7.5' Topographic Map).
U. S. Geological Survey, 1972. Gibsonton, Florida (7.5' Topographic Map).

FIGURE 17. Approximate Water Table Elevation Contours at MacDill AFB, October 1983

to the coastal plain on the east. Elevations on the flatland range from 30 to 100 feet (9 to 30 meters) above msl.

Major surface water features at Avon Park include Lake Arbuckle, Arbuckle Creek (which flows from Lake Arbuckle to Lake Istopoga to the south), and Morgan Hole Creek. The Kissimmee River traverses part of the east range boundary. There are also numerous lakes and ponds located on the flatland in the eastern portion of the range.

Surface deposits at Avon Park AFR consist of quartz sand, peat, and river alluvium, to a depth of approximately 20 feet (6 meters). At higher elevations along the ridge, surface sands are about 100 feet (30 meters) thick. Hydraulic conductivity of the surface sands is approximately 100 gpd/ft^2 (4.72×10^{-5} m/sec). Below the surface sands, the Tamiami and Hawthorne Formations are present. These strata, consisting mostly of clay, are approximately 300 feet (90 meters) thick at Avon Park AFR and form a very effective confining layer of extremely low hydraulic conductivity. Below the Hawthorne Formation there is a thick sequence of carbonate rock consisting of limestone and dolomite. This carbonate section, in particular the Lake City Limestone occurring at approximately 900 feet (270 meters) below land surface, is the principal source of water in this area, and is referred to as the Floridan Aquifer.

Groundwater occurs under both water table and artesian conditions at Avon Park AFR. The water table aquifer occurs in the surface sand deposits and is recharged locally by rainfall. The water table aquifer is the first to receive any surface contamination. Movement within this zone is very slow due to low hydraulic gradients. Discharge of water from the aquifer is by evapotranspiration, lateral seepage to a stream or lake, or downward movement to the Floridan Aquifer depending on factors described above for MacDill AFB.

The Floridan Aquifer occurs under artesian conditions (i.e., water levels in wells completed in this aquifer will rise above the top of the aquifer). The clay-confining bedr of the Tamiami and Hawthorne Formations limit vertical movement of water from the water table to the Floridan Aquifer. However, recharge is greater where sinkholes have breached the confining beds. This has occurred at some of the lakes along the ridge, including Lake Arbuckle. Therefore, contaminants reaching one of these lakes could also reach the Floridan Aquifer through the hydraulic connection provided by the sinkholes.

The Floridan Aquifer provides nearly all of the municipal and irrigation water in the area. Avon Park AFR receives its water supply from two wells located near Lake Arbuckle and two wells located near the air field. This system is maintained by the Florida Department of Corrections.

3.0 FIELD PROGRAM

3.0 FIELD PROGRAM

3.1 DEVELOPMENT OF THE FIELD PROGRAM

WAR and the Occupational and Environmental Health Laboratory (OEHL) developed the scope of work in three iterations. Initially, the Phase I contractor used the Phase I findings to develop recommended work scopes at most sites (Moccia et al., 1981). This work served as preliminary information for the Phase IIa presurvey investigation (WAR, 1983). OEHL advised WAR (the presurvey contractor) to add Sites A, 17, and 23 to the list of sites recommended for field investigation. Site A was discovered by base personnel after the Phase I study was completed. Sites 17 and 23 were reevaluated by the Phase I contractor between the completion of the original Phase I report and the presurvey. This resulted in hazard assessment ratings for these two sites which were approximately the same as ratings for the sites originally recommended for field investigation.

In general, work recommended as a result of the presurvey was similar to that recommended in Phase I, except for addition of work at the new sites.

Following OEHL's review of the presurvey recommendations, WAR and OEHL developed the final work scope. It was similar to that recommended by the presurvey; however, OEHL elected to delete two sites (11 and 13) and to omit repetitive sampling in the final scope of work.

WAR and OEHL devised work at each site by considering types of waste potentially disposed of at a site (Table 1), nearby water resources and hydrology, and nearby human and environmental systems which could be affected by mobile contaminants. The principal concept of the final work scope was to detect (within time and budget limitations) evidence of contaminant movement. WAR used technical observation and judgment to identify methods by which to encounter any such potential pollutant migration. Technical observations involved assessing site soil characteristics, topography, reported stratigraphy and hydrogeology, location and

biological character of nearby surface water, and location and type of uses of nearby surface and subsurface water resources.

WAR and OEHL selected constituents for monitoring based on types of materials (wastes) potentially present, and for budgetary reasons, selected screening analyses to monitor most sites. Two of the screening analyses (pH and specific conductance) measure gross physical properties of a sample. The other screening analyses (oil and grease, DOC, TOX, and phenolics) measure the cumulative concentration of an entire class of organic compounds without identifying specific compounds present in a sample. In certain instances, the history of a site warranted use of analyses for specific contaminants. Depending upon the site, these analyses included lead, PCB, organochlorine pesticides, volatile organic aromatics (VOA), and volatile organic halocarbons (VOH).

WAR and OEHL elected to not define background water quality because most waste substances of interest do not occur naturally. This decision was made to conserve budget within the context of a screening program. Nonetheless, in some of the analyses used, naturally occurring substances are sometimes detected along with waste substances. For this reason, negative results (i.e., undetected or low substance levels) were to be interpreted as indicating no contaminant movement from a site. Positive results were to be interpreted as inconclusive, and to serve principally as indicators of a need for more comprehensive field assessment.

A positive result is indicated in one of two ways:

1. For water quality contituents for which a numerical standard exists, if the level detected equals or exceeds the standard (even though some or all of what is detected may later be found to be from natural sources), the result is considered positive.
2. For other constitutents, because no site-specific background levels are determined, the level detected is judged significant (positive) if it lies outside a range of expected background

values inferred from water quality of other similar water resources and/or from results of other Phase II samples. Additional (future) field assessments could include determining site-specific background levels.

WAR gave attention to selecting appropriate media (e.g., soil, water) for sampling and analysis and selected media to provide the best indication of contaminant mobility (if any) relative to human or environmental systems identified as potentially at risk. At most sites, field work involved sampling and analysis of groundwater. The work scope called for field staff to examine soils in dug pits at Site 16. WAR emphasized sampling of groundwater because the subsurface flow is the principal route for contaminant movement, if any. On-site staff did not observe any surface collection or discharge of leachate from sites.

Table 1 lists those sites included in the final scope of work. Also shown in the table are suspected types of waste for each site. Table 4 indicates the sampling schedule for each site except Site A which involved field observations only. Some information in these tables is summarized in Table 5 which gives a summary and explanation of field work planned for each site at MacDill AFB and Avon Park AFR.

3.2 IMPLEMENTATION OF THE FIELD PROGRAM

3.2.1 Monitor Well Installation

All monitor wells were installed by a subcontractor (Pittsburgh Testing Laboratory, Inc.) under the supervision of a WAR hydrogeologist. Each monitor well was constructed to have both an efficient hydraulic connection to the surrounding water table aquifer and an effective seal against the migration of surface water into the borehole. Special care was taken to protect against cross-contamination between wells.

The following techniques and materials were used to accomplish these aims:

Table 4. Schedule of Samples for MacDill AFB and Avon Park AFR, November 1983

Station	pH	Sp. Cond.	Oil and Grease	Lead	DOC*	TOX	PCBs	Phenolics	Organochlorine Pesticides†	Volatile Aromatics**	Volatile Halocarbons††
MD 16-1	G	G	G	G							
MD 16-2	G	G	G	G							
MD 16-3	G	G	G	G							
MD 16-4	G	G	G	G							
MD 16-5	G	G	G	G							
MD 16-6	G	G	G	G							
MD 16-7	G	G	G	G							
MD 3-1	G	G			G	G	G				
MD 3-2	G	G			G	G	G				G
MD 3-3	G	G			G	G	G				
MD 3-4	G	G			G	G	G				G
MD 3-5	G	G			G	G	G				
MD 58-1	G	G			G	G		G			
MD 58-2	G	G			G	G		G			
MD 58-3	G	G			G	G		G			
MD 58-4	G	G			G	G		G			
MD 9-1	G	G			G	G		G			
MD 9-2	G	G			G	G		G			
MD 9-3	G	G			G	G		G			
MD 17-1	G	G			G	G	G	G			
MD 17-2	G	G			G	G	G	G			
MD 23-1	G	G		G	G	G					
MS 23-2	G	G		G	G	G					
MD 23-3	G	G		G	G	G				G	G
MD 23-4	G	G		G	G	G					
MD 23-5	G	G		G	G	G					
MD 23-6	G	G		G	G	G				G	G
AP 6-1	G	G		G	G	G					
AP 6-2	G	G		G	G	G					
AP 6-3	G	G		G	G	G					
AP 7-1	G	G			G	G		G	G		
AP 7-2	G	G			G	G		G	G		
AP 7-3	G	G			G	G		G	G		
AP 11-1	G	G							G		
AP 11-2	G	G							G		

G = groundwater sample.
*The sample was filtered through a 0.45-micron filter before preservation with H_2SO_4. This ensures that the test results are representative of dissolved species which would migrate in groundwater.
†Organochlorine pesticides (aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, and methoxychlor).
**Volatile aromatics (benzene, ethyl benzene, toluene, and xylene).
††Volatile halocarbons (bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, 2-chloroethylvinyl ether, chloroform, chloromethane, dibromochloromethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, dichlorodifluoromethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, trans-1, 2-dichloroethene, cis-1, 3-dichloropropene, trans-1, 3-dichloropropene, methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, trichlorofluoromethane, vinyl chloride).

Table 5. Summary of and Rationale for Field Investigation at MacDill AFB and Avon Park AFR (Page 1 of 2)

Site	Principal Potential Wastes	Nearby Human/ Environmental Systems	Outline of Sampling Activities	Constituents Analyzed for	Rationale Results can provide evidence of movement of:
MacDill AFB Site 16 Fuel Tank Farm	Fuel leak; tank bottom sludges	Mangroves and surface waters	o Dig eight open pits to two feet below groundwater surface and visually inspect soil. o Sample water standing in four pits.	Observation Oil and grease	Fuel through soils Heavier molecular fractions of fuels and some lighter molecular fractions of fuels.
				Lead	Leaded fuel, undiluted or minimally diluted by ambient groundwater.
				pH and Sp. Cond.	Nonspecific toxic contaminants.
Site 3 Landfill at Dog Kennel	Paints, solvents, PCB capacitors	Mangroves and groundwater	o Install three wells 15 feet deep. o Sample three wells plus two existing wells near spray irrigation field.	GWCI*	Nonspecific ionic substances, chlorinated hydrocarbons, and nonchlorinated hydrocarbons (such as those in paints, solvents, pesticides, and PCB compounds at concentrations expected prior to extensive dilution by ambient groundwater.
				PCB	PCB compounds, even after substantial dilution.
				VOH	Typically used solvents and degreasers even after substantial dilution by ambient groundwater.
Sites 5-8 Past Landfills	Paints, solvents, PCB capacitors	Surface waters and mangroves	o Install four wells 15 feet deep. o Sample each well.	GWCI	Nonspecific ionic substances, chlorinated hydrocarbons, and nonchlorinated hydrocarbons (such as those in paints, solvents, pesticides, and PCB compounds) at concentrations expected prior to extensive dilution by ambient groundwater.
				Phenolics	Phenolic compounds used in paint strippers, even after substantial dilution.
Site 9 Current Landfill	Paints, solvents, PCB capacitors	Surface waters and mangroves	o Install three wells 20 feet deep. o Sample each well.	GWCI	Nonspecific ionic substances, chlorinated hydrocarbons, and nonchlorinated hydrocarbons (such as those in paints, solvents, pesticides, and PCB compounds) at concentrations expected prior to extensive dilution by ambient groundwater.
				Phenolics	Phenolic compounds used in paint strippers, even after substantial dilution.
Site A Former Fuel Storage Adjacent to AGE	Fuel leaks	None	o Install four temporary wells 10 feet deep. o Use transparent bailer to observe fuel layer.	In situ observations of fuel floating in groundwater, if any.	Evidence of fuel presence and potential for recovery.
Site 17 Drum Storage Area	PCBs; waste oils, solvents, fuel sludges containing lead	Groundwater	o Install two wells 20 feet deep. o Sample each week.	GWCI	Nonspecific ionic substances, chlorinated hydrocarbons, and nonchlorinated hydrocarbons (such as those in paints, solvents, pesticides, and PCB compounds) at concentrations expected prior to extensive dilution by ambient groundwater. Note: lead omitted because of expected substantial dilution and suspected small amounts of fuel additives.

Table 5. Summary of and Rationale for Field Investigation at MacDill AFB and Avon Park AFR (Page 2 of 2)

Site	Principal Potential Wastes	Nearby Human/ Environmental Systems	Outline of Sampling Activities	Constituents Analyzed for	Rationale Results can provide evidence of movement of:
Site 17 (Continued)				PCB	PCB compounds, even after substantial dilution.
				Phenolics	Phenolic compounds used in paint strippers, even after substantial dilution.
Site 23 Fire Training Areas	Fuel additives, toxic fuel components, solvents	Groundwater	o Install six wells 20 feet deep. o Sample each well.	GWCI	Nonspecific ionic substances, chlorinated hydrocarbons, and nonchlorinated hydrocarbons (such as those in paints, solvents, pesticides, and PCB compounds) at concentrations expected prior to extensive dilution by ambient groundwater.
				Lead	Leaded fuel, undiluted or minimally diluted by ambient groundwater.
				VOH	Typically used solvents and degreasers even after substantial dilution by ambient groundwater.
				VOA	Toxic components of fuel (fuel additives), even after substantial dilution by ambient groundwater.
Avon Park AFR					
AP-6 Old Landfill	Oils, solvents, paints, fuel additives	Surface waters and farming activities	o Install three wells 15 feet deep. o Sample each well.	GWCI	Nonspecific ionic substances, chlorinated hydro- those in paints, solvents, pesticides, and PCB compounds) at concentrations expected prior to extensive dilution by ambient groundwater.
				Lead	Leaded fuel, undiluted or minimally diluted by ambient groundwater.
AP-7 Current Landfill	Oils, solvents, paints, pesticides	Surface waters and groundwater	o Install three wells 15 feet deep. o Sample each well.	GWCI	Nonspecific ionic substances, chlorinated hydrocarbons, and nonchlorinated hydrocarbons (such as those in paints, solvent, pesticides, and PCB compounds) at concentrations expected prior to extensive dilution by ambient groundwater.
				Phenolics	Phenolic compounds used in paint strippers, even after substantial dilution.
				Organochlorine pesticides	Persistent pesticide wastes, even at diluted concentrations.
AP-11 Pesticide Rinse water Basin	Pesticide residues	Surface waters	o Install two wells 10 feet deep. o Sample each week.	Organochlorine pesticides	Persistent pesticide wastes, even at diluted concentrations.

*GWCI = Groundwater contamination indicators (specific conductance, pH, DOC, and TOX).

1. Hollow-stem augers [7 7/8-inch outside diameter (OD)] were used to drill all boreholes. Although the scope of work (Appendix B) specified well depths for each site, conditions encountered in the field dictated shallower depths for many wells. In some instances, drilling was stopped to avoid completing a well in the clays of the Hawthorne Formation which is the confining bed beneath the water table aquifer. In other cases, wells were completed at a shallower depth to set the well screen in a zone of apparent contamination. Representative lithologic samples were collected by ASTM D-1586-67 every 5 feet for preparation of the lithologic log (Appendix D).
2. A string of clean, threaded, flush-joint, 2-inch, schedule 40 PVC well casing and well screen (0.010-inch slot) was installed through the hollow-stem augers.
3. A filter pack of 20-30 sand was placed around the PVC well screen and casing as the hollow-stem augers were withdrawn.
4. A 1- to 2-foot seal of bentonite was placed on top of the sand. At some wells, the hole collapsed to within 2 feet of the ground surface when the augers were withdrawn. In these instances, the bentonite seal was not installed.
5. The remainder of the annular space was filled with a sand-cement (2:1) grout.
6. A 5-foot-long, 6-inch diameter, steel protective casing was installed approximately 3 feet into the grout and equipped with a padlock. The aboveground portions of both the PVC casing and the protective casing were vented.
7. Each well was developed by pumping it until the discharge was clear.
8. All down-hole tools were washed with potable water between holes to prevent cross-contamination. All well casings and screens were washed with potable water before installation.

3.2.2 Sample Collection

WAR sampled all Phase IIb sites at MacDill AFB and Avon Park AFR during the period November 17-20, 1983. Collection of a groundwater sample from a monitor well followed these steps:

1. Measurement of the depth to water from the top of the casing;
2. Determination of the volume of water contained in the well casing and screen (the well volume);
3. Pumping or bailing at least five well volumes of water from the well;
4. Measurement of specific conductance, temperature, and pH of the last fraction of water removed from the well in Step 3; and
5. Sample collection and preservation following the procedures described for each sample fraction in Appendix E [Laboratory Methods and Quality Assurance/Quality Control (QA/QC) Plan].

Table 4 depicts the sample fractions collected from each monitor well at MacDill AFB and Avon Park AFR. Field data sheets (Appendix F) record all field measurements, sample bottle numbers, and observations for a given station.

Sample collection at Site MD16 (Fuel Tank Farm--MacDill) consisted of digging a pit well and performing Steps 4 and 5 above. Each of the pit wells tended to cave-in; this tendency was so pronounced at station MD16-8 that it was impossible to collect a sample.

Use of a transparent bailer to estimate the quantity of fuel on top of the groundwater at Site A was unsuccessful because the bailer did not sample the fluid column uniformly. Consequently, WAR determined the thickness of the fuel layer in wells MDA1 through MDA4 by noting the depth (from the top of the casing) to the top of the fluid level in a well and the top of the water column in the well using a conductivity probe attached to a measuring tape. The difference in the two measurements was the thickness of nonconductive fluid (presumably fuel) at that point.

4.0 DISCUSSION OF RESULTS AND SIGNIFICANT FINDINGS

4.0 DISCUSSION OF RESULTS AND SIGNIFICANT FINDINGS

4.1 RELEVANT WATER QUALITY CRITERIA AND STANDARDS

4.1.1 Florida Groundwater Quality Standards

All groundwaters sampled during the MacDill AFB Phase IIb survey are classified G-II according to the Florida Department of Environmental Regulation (FDER) (Boyes, 1984). Section 17-3.404 of the Florida Water Quality Standards (FWQS) states that all Class G-I and G-II groundwaters must meet Florida primary and secondary drinking water standards established by the Florida Safe Drinking Water Act, unless natural background concentrations exceed the standards or the water in question is within a permitted zone of discharge. Table 6 lists maximum contaminant levels (MCLs) established by Florida drinking water regulations for parameters analyzed in the Phase IIb survey. FDER has not established MCLs for all survey parameters.

Groundwater in the Floridan Aquifer is classified according to TDS content of the groundwater. Class G-II groundwaters are those containing less than 3,000 mg/l TDS; groundwaters containing more than 3,000 mg/l TDS but less than 10,000 mg/l TDS fall within Class G-III. As discussed above, certain MCLs have been established for Class G-II groundwaters. In addition, both classifications are protected by the nondegradation clauses of FAC 17-3.402 which, in essence, prohibit the introduction of toxic, carcinogenic, mutagenic, or teratogenic substances into the aquifer. The intent of this is to protect groundwater supplies which may be developed with the aid of future technologies.

Inspection of the MacDill AFB Phase IIb data indicates that concentrations of the six parameters listed in Table 6 are within MCLs, with the possible exception of pH. Upgradient (background) wells were not installed at MacDill AFB disposal sites, thus a true background pH for the sites cannot be established. However, the pH range of 5.0 to 7.0 for MacDill Phase IIb data is consistent with the range of natural background pH (4.9 to 7.6) for shallow groundwater in the central Florida area

Table 6. Relevant MCLs for Drinking Water*

Parameter	EPA Interim Drinking Water Standards†	Florida Drinking Water Regulations**
	Primary Standards (ug/l)	
Lead	50	50
Endrin	0.2	0.2
Lindane	4	4
Methoxychlor	100	100
Total trihalomethanes††	100	100
	Secondary Standards (ug/l except for pH)	
pH***	6.5 - 8.5	6.5 (minimum allowable; no maximum)

*MCLs are given only for parameters which analytical results are reported in the MacDill AFB Phase IIb survey.

**Source: Florida Drinking Water Regulations, Section 17-22.104 FAC

†Source: EPA National Interim Drinking Water Regulations, 40 CFR 143.

††Sum of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform).

***The pH of natural groundwater in water table aquifers in central Florida reportedly varies from 4.9 to 7.6 (Stewart, 1966).

(Stewart, 1966). Paragraph 17-3.404(2) of the FWQS states that if the natural background pH is lower than the minimum, the background value shall be the prevailing standard.

Paragraph 17-3.404 of the FWQS states that drinking water standards do not apply to groundwaters within a permitted zone of discharge. There are no such permited zones for the study sites at MacDill AFB or Avon Park AFR, thus this exemption from the standards does not apply.

4.1.2 EPA Interim Drinking Water Regulations

Standards established by these regulations are not directly applicable to groundwater sampled during the MacDill AFB Phase IIb survey, as the regulations pertain to public water systems. However, MCLs established by EPA interim primary and secondary drinking water regulations are nearly identical to those established by FDER. For parameters analyzed during this survey, the only difference between EPA and Florida MCLs is the absence of an upper limit on pH for the Florida MCLs. Since none of the pH values recorded during the MacDill AFB Phase IIb survey exceed the EPA MCL maximum of 8.5 units, the EPA and Florida MCLs are identical for the purposes of this report. In all subsequent discussions, the term MCL will refer to the contaminant levels listed in Table 6, which are applicable under Florida regulations to all groundwaters sampled.

4.1.3 Florida Criteria for Surface Waters

FWQS, Chapter 17-3 of the Florida Administrative Code (FAC), give criteria for three classes of water relevant to the MacDill AFB Phase IIb survey. These are:

1. General (all surface waters except within zones of mixing);
2. Class II (surface waters for shellfish harvesting or propagation); and
3. Class III (surface waters for recreation, propagation, and management of fish and wildlife).

FAC 17-3.161 classifies surface waters at MacDill AFB as both Class II and Class III waters. Class II waters lie along the southern shore of the base from Gadsden Point west to the base boundary and landward to the line of mean high water; this includes surface waters adjacent to Site 16 and Landfills 3, 5-8, and 9. All other surface waters at MacDill AFB and those at Avon Park AFR fall within Class III waters.

Surface water criteria for water bodies nearest the disposal sites are cited (Table 7) only for the basis of comparing groundwater quality to the receiving surface water.

4.1.4 EPA Water Quality Criteria

EPA has established water quality criteria for 64 toxic pollutants or pollutant categories (EPA, 1980). Criteria are given for freshwater and saltwater aquatic life and human health; however, EPA water quality criteria are intended as guidelines and have no regulatory impact. A summary of criteria for parameters analyzed in the MacDill AFB Phase IIb survey is given in Table 8.

Human health criteria are derived from animal toxicity data and are given as ambient criteria for noncarcinogenic pollutants, and concentrations estimated to cause a specified level of incremental cancer risk for carcinogens. Human health criteria assume that intake of the pollutant comes from two sources: (1) drinking an average of 2 liters of water per day, and (2) ingesting an average of 6.5 grams of fish per day. Concentrations shown for incremental cancer risk in Table 8 indicate those which are estimated to cause an incremental cancer risk over a lifetime of 10^{-6}, or one cancer in a population of 1 million. Methodologies for determining human health criteria are discussed in detail by EPA (1980).

For the purpose of this survey, EPA criteria are used as a comparison to groundwater quality, particularly for phenolic and purgeable organic compounds. If groundwater concentrations of a particular pollutant

Table 7. Summary of Relevant Florida Water Quality Criteria* (Page 1 of 3)

Parameter	General Surface Water Criteria	Class II Surface Water Criteria	Class III Surface Water Criteria
Lead	Shall not exceed 0.05 mg/l.		Shall not exceed 0.03 mg/l in predominantly fresh waters.
Oil and Grease	1. Dissolved or emulsified oils and greases shall not exceed 5.0 mg/l. 2. No undissolved oil, or visible oil defined as iridescence, shall be present to cause taste or odor, or otherwise interfere with the beneficial uses of waters.		
pH	Shall not vary more than one unit above or below natural background provided that the pH is not lowered to less than 6 units or raised above 8.5 units. If natural background is less than 6 units, the pH shall not vary below natural background or vary more than one unit above natural background. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below background.	Shall not vary more than one unit above or below natural background of coastal waters as defined in 17-3.05(1)(c), FAC, or more than two-tenths unit above or below natural background of open waters as defined in 17-3.05(a)(c), FAC, provided that the pH is not lowered to less than 6.5 units or raised above 8.5 units. If natural background is less than 6.5 units, the pH shall not vary below natural background or vary more than one unit above natural background for coastal waters or more than two-tenths unit above natural background for open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of coastal waters or more than two-tenths unit below natural background of open waters.	Shall not vary more than one unit above or below natural background of predominantly fresh waters and coastal waters as defined in 17-3.05(1)(c), FAC, or more than two-tenths unit above or below natural background of open waters as defined in 17-3.05(1)(c), FAC, provided that the pH is not lowered to less than 6 units in predominantly fresh waters, or less than 6.5 units in predominantly marine waters, or raised above 8.5 units. If natural background is less than 6 units, in predominantly fresh waters or 6.5 units in predominantly marine waters, the pH shall not vary below natural background or vary more than one unit above natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit above natural background of open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit below natural background of open waters.

Table 7. Summary of Relevant Florida Water Quality Criteria* (Page 2 of 3)

Parameter	General Surface Water Criteria	Class II Surface Water Criteria	Class III Surface Water Criteria
Phenolic Compounds	Chlorinated phenols including trichlorophenols; chlorinated creosols; 2-chlorophenol; 2,4-dichlorophenol and pentachlorophenol; 2,4-dinitrophenol; phenol-shall not exceed 1.0 ug/l unless higher values are shown not to be chronically toxic. Such higher values shall be approved in writing by the Secretary. Phenolic compounds other than those produced by the natural decay of plant material, named or unnamed, shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.		
Specific Conductance	Shall not be increased more than 100% above background levels or to a maximum level of 500 umhos/cm in surface waters in which the specific conductance of the water at the surface is less than 500 umhos/cm; and shall not be increased more than 50% above background level or to a maximum level of 5,000 umhos/cm in surface waters in which the specific conductance of the water at the surface is equal to or greater than 500 umhos/cm but less than 5,000 umhos/cm.		

Table 7. Summary of Relevant Florida Water Quality Criteria* (Page 3 of 3)

Parameter	General Surface Water Criteria	Class II Surface Water Criteria	Class III Surface Water Criteria
Aldrin plus dieldrin		Shall not exceed 0.003 ug/l.	Shall not exceed 0.003 ug/l.
DDT		Shall not exceed 0.001 ug/l.	Shall not exceed 0.001 ug/l.
Endrin		Shall not exceed 0.004 ug/l.	Shall not exceed 0.004 ug/l.
Heptachlor		Shall not exceed 0.001 ug/l.	Shall not exceed 0.001 ug/l.
Lindane		Shall not exceed 0.004 ug/l.	Shall not exceed 0.004 ug/l.
Methoxychlor		Shall not exceed 0.03 ug/l.	Shall not exceed 0.03 ug/l.

*Criteria are given only for parameters for which analytical results are reported in the MacDill Phase IIb survey.

Table 8. Relevant EPA Water Quality Criteria (Page 1 of 2)

Parameter	Criteria for Freshwater Aquatic Life, ug/l: Acute Toxicity Level*	Criteria for Freshwater Aquatic Life, ug/l: Chronic Toxicity Level*	Criteria for Freshwater Aquatic Life, ug/l: Maximum 24-hr. Average	Criteria for Freshwater Aquatic Life, ug/l: Maximum Concentration	Criteria for Saltwater Aquatic Life, ug/l: Acute Toxicity Level*	Criteria for Saltwater Aquatic Life, ug/l: Chronic Toxicity Level*	Criteria for Saltwater Aquatic Life, ug/l: Maximum 24-hr. Average	Criteria for Saltwater Aquatic Life, ug/l: Maximum Concentration	Human Health Criteria, ug/l: Potable Water Taste/Odor Control††	Human Health Criteria, ug/l: Ingestion of Water and Aquatic Organisms: Ambient Criterion	Human Health Criteria, ug/l: Ingestion of Water and Aquatic Organisms: 10^{-6} Incremental Cancer Risk
HEAVY METALS											
Lead					668	25				50	
VOH											
Carbon tetrachloride	35,200				50,000					0**	0.40
Chlorinated benzenes	250	50†			160	129				0**	0.0072
Chlorinated ethanes											
1,2-dichloroethane	118,000	20,000			113,000					0**	0.94
1,1,1-trichloroethane					31,200					18.4	
1,1,2-trichloroethane		9,400								0**	0.60
Chloroform	28,900	1,240								0**	0.19
Dichlorobenzenes	1,120	763			1,970					400	
Dichloropropenes	6,060	244			790					14.1	
Vinyl chloride										0**	2.0
VOA											
Benzene	5,300				5,100	700†				0**	0.66
Ethyl benzene	32,000				430					1.4	
Toluene	17,500				6,300	5,000				14.3	
PHENOLIC COMPOUNDS											
CHLORINATED PHENOLS											
4-chloro-3-methylphenol	30										
2,3,5,6-tetrachlorophenol					440						
4-chlorophenol					29,700						
3-monochlorophenol									0.10		
4-monochlorophenol									0.10		
2,3-dichlorophenol									0.04		
2,5-dichlorophenol									0.50		
2,6-dichlorophenol									0.20		
3,4-dichlorophenol									0.30		
2,3,4,6-tetracholorophenol									1.0		
2,4,5-trichlorophenol									1.0	2,600	
2,4,6-trichlorophenol		970				970			2.0	0**	1.2
2-methyl-4-chlorophenol									1,800		
3-methyl-4-chlorophenol									3,000		
3-methyl-6-chlorophenol									20		
2-chlorophenol		4,380	2,000†						0.10		
2,4-dichlorophenol		2,020	365						0.30	3.09	
2,4-dimethylphenol		2,120							400		
Nitrophenols	230	150†			4,850						
2,4-dinitro-o-cresol										13.4	
dinitrophenol										70	
Pentachlorophenol					53	34			30	1,010	
Phenol					5,800				0.30	3.5	

Table 8. Relevant EPA Water Quality Criteria (Page 2 of 2)

Parameter	Criteria for Freshwater Aquatic Life, ug/l				Criteria for Saltwater Aquatic Life, ug/l				Human Health Criteria, ug/l		
										Ingestion of Water and Aquatic Organisms	
	Acute Toxicity Level*	Chronic Toxicity Level*	Maximum 24-hr. Average	Maximum Concentration	Acute Toxicity Level*	Chronic Toxicity Level*	Maximum 24-hr. Average	Maximum Concentration	Potable Water Taste/Odor Control††	Ambient Criterion	10^{-6} Incremental Cancer Risk
CHLORINATED HYDROCARBON PESTICIDES											
Aldrin				3.0				1.3			0.000074
Dieldrin			0.0019	2.5			0.0019	0.71		0**	0.000071
DDT			0.0010	1.1			0.0010	0.13			0.000024
DDE	1,050				14						
Endrin			0.0023	0.18			0.0023	0.037		1	
Heptachlor			0.0038	0.52			0.0036	0.053		0**	.00028
Lindane			0.08	2				0.16			
PCSs	2†		0.014		10†		0.030			0**	.00079

*Toxicity may occur at lower concentrations among species more sensitive than those tested.
**Zero level may not be attainable at this time.
†Data is not definitive.
††Organoleptic data used as basis for taste and odor control have no demonstrated relationship to adverse human health effects.

Source: EPA, 1980.

exceed the EPA criteria, it cannot be stated with certainty that the water will be adversely impacted due to the difficulty in quantifying transport of the pollutant. However, if groundwater concentrations are below EPA water quality criteria, it can be reasonably assumed that the surface water will not be adversely impacted.

4.2 ANALYTICAL RESULTS

Sample collection and field measurement of pH and specific conductance were performed between November 17 and 20, 1983. Results of analyses are discussed in Section 4.3. Analytical methods and QA/QC results are discussed in Appendix E. Analytical quality control data are summarized in Table E-3 of Appendix E.

4.3 DISCUSSION OF RESULTS

4.3.1 General

Results of analyses on environmental samples collected during the MacDill AFB Phase IIb survey are discussed in terms of relevant water quality standards and criteria whenever possible. All groundwater sampled during the survey is classified G-II by the state of Florida, and must conform to MCLs established by Florida drinking water regulations. Of the parameters analyzed in this survey, MCLs are established for endrin, lindane, methoxychlor, lead, pH, and total trihalomethanes (THMs) (see Table 6). Florida drinking water MCLs are identical to MCLs established by EPA interim drinking water regulations for parameters analyzed.

Where MCLs are not available for direct comparison, Florida criteria for surface water nearest the site or EPA water quality criteria can be used to compare with groundwater quality. This is an indirect comparison, and in order to estimate the potential impact of groundwater quality on the receiving surface water the following factors must be taken into account:

1. Rate of migration of the contaminant from shallow groundwater to the adjacent surface water; and

2. Fate of the contaminant once it reaches the surface water (i.e., is it rapidly dispersed, does it remain in solution, is it adsorbed to sediments or vegetation, etc.).

With the limited data available at MacDill AFB disposal sites, these factors cannot be quantified. Thus, if groundwater concentrations of a particular pollutant exceeds adjacent surface water criteria it cannot be said with certainty that the surface water will be adversely impacted. However, if groundwater parameters are within adjacent surface water criteria, it can be stated with certainty that the surface water criteria will not be exceeded due to groundwater discharge. Florida surface water criteria are listed in Table 7 for lead, oil and grease, pH, phenolic compounds (particularly chlorinated phenolics), specific conductance, and dichloro-diphenyl-trichloro-ethane (DDT).

The Florida general surface water criterion for chlorinated phenolics is 1 ug/l. EPA has established water quality criteria for 21 specific phenolic compounds, as listed in Table 8. These criteria can be used for comparison with total phenolic data only to determine whether the potential exists for criteria to be exceeded. If the total phenolic concentration of a water sample exceeds a criterion for a specific phenolic compound or group of phenolic compounds, then the potential exists for that criterion to be exceeded.

EPA water quality criteria are listed in Table 8 for metals, purgeable organics, and phenolic compounds. EPA water quality criteria are not established for all purgeable organic compounds analyzed in the MacDill AFB Phase IIb survey. For detected compounds without criteria, published toxicity data are used to assess potential environmental and human health hazards.

TOX measures organohalides which are organic compounds containing one or more halogens (fluorine, chlorine, bromine, iodine, and astatine). The organohalides constitute a very large class of organic compounds with

widespread use in modern society. Organochlorine pesticides, PCBs, VOH, and chlorinated phenolics are examples of organohalides, but these examples are far from a complete listing.

There are no criteria or standards for direct evaluation of TOX data. If used in a rigorous manner (e.g., RCRA compliance monitoring), extensive background and monitoring data bases are required to determine statistically whether monitoring well levels are significantly higher than background well levels. When used as a screening indicator, as is the case with the MacDill AFB Phase IIb survey, such data are not available. For the purposes of interpreting TOX data reported in this survey, a TOX concentration of 40 ug Cl^-/l was selected as being sufficiently high to indicate the potential for significant groundwater contamination. This concentration is based on the Florida/EPA MCL for THMs which is 100 ug/l for the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane concentrations. Molecular weights for these species range from 119.4 for chloroform to 252.8 for bromoform. A chloroform concentration of 100 ug/l would be equivalent to 89 ug Cl^-/l reported as TOX, the ratio of the chloride weight (3 X 35.5 = 106.5) to the molecular weight (119.4). A bromoform concentration of 100 ug/l would be equivalent to 42 ug Cl^-/l reported as TOX, the ratio of the halogen weight reported as chlorine (3 X 35.5 = 106.5) to the molecular weight (252.8). The cut-off level for TOX, 40 ug Cl^-/l, was based on the concentration of bromoform that could be present in a sample without exceeding the 100 ug/l THM standard. A TOX concentration of 40 ug Cl^-/l corresponds to a range of 45 ug/l (all chloroform) to 95 ug/l (all bromoform) total THMs. These comparisons are based on molecular weight considerations only and assume 100 percent accuracy of analytical methods.

Similarly, there are no criteria or standards for direct evaluation of DOC data. Background DOC concentrations in natural water samples can vary widely, depending primarily on decomposition of organic matter in

the soil. DOC data for this survey are evaluated subjectively as an indication of general organic contamination.

The expected range of pH and specific conductance of natural background, fresh groundwater from the water table aquifer in central Florida may be derived from Stewart (1966). He found that pH varied from 4.9 to 7.6, and specific conductance varied from 16.2 umhos/cm to 924 umhos/cm. This range of specific conductance (essentially 10 to 1,000 umhos/cm) indicates that dissolved solids concentrations in fresh groundwater varies widely. Evaluation of specific conductance data in this study includes consideration of the expected range of natural background, proximity of brackish water, and consistence of specific conductance data among wells at a given study site.

4.3.2 MacDill AFB Sites

4.3.2.1 Site 16, Fuel Tank Farm--The pH (range of 6.0 to 6.6) for all stations and specific conductance (range of 230 to 490 umhos/cm) values for six of the seven wells (Table 9) are within the range of natural background levels for the area (pH >4.9 and specific conductance 10 to 1,000 umhos/cm). The well at station MD16-4 had a specific conductance of 1,950 umhos/cm, but is suspected to be influenced by tidal intrusion (see location on Figure 4) since it is the most downstream sampling station at Site 16.

Oil and grease levels in four of the wells at this site exceed the Florida general surface water criteria of 5 mg/l. However, due to the nature of the sampling (i.e., pit wells and grab sampling) and the soil strata (mostly sand), large quantities of solids were present in the samples. Oil and grease adsorbed on the surfaces of these particles could have increased the results of the oil and grease analyses.

All wells except one, MD16-1, exhibited no detectable quantity of lead. Station 16-1 had a level of 40 ug/l, which is below the MCL of 50 ug/l.

Table 9. Results of Analyses of Groundwater Collected in the Vicinity of Site 16—Fuel Tank Farm, MacDill AFB, November 1983

Parameter	Stations							
	16-1	16-2	16-3	16-4	16-5	16-6*	16-6*	16-7
pH	6.6	6.0	6.1	6.3	6.0	6.1	NA	6.4
Sp. cond. (umhos/cm)**	310	255	350	1,950	230	300	NA	490
Oil and grease (mg/l)	39.0	7.7	0.5	0.3	22.0	10.2	1.6	<0.1
Lead (ug/l)	40	<30	<30	<30	<30	<30	<30	<30

*Duplicate sample.
**Corrected to 25°C.

Table 10. Results of Analyses of Groundwater Collected in the Vicinity of Landfill 3, MacDill AFB, November 1983

Parameter	Wells					
	3-1	3-2	3-3	3-4	3-5*	3-5*
pH	6.6	6.8	6.8	6.4	5.1	NA
Sp. cond. (umhos/cm)**	3,310	3,660	1,180	1,810	280	NA
DOC (mg/l)	18	24	16	58	80	NA
TOX (ug Cl^-/l)	110	120	†	260	260	NA
PCBs (ug/l)	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
VOH	NA	***	NA	***	NA	NA

NA = Not analyzed.
*Duplicate sample.
**Corrected to 25°C.
***Refer to Table 11 for results.
†Sample container broken in shipping.

4.3.2.2 Landfill 3, Landfill at Dog Kennel--Groundwater contamination indicators (GWCI) at this site indicate a possibility of groundwater contamination (Table 10). The pH values (5.1 to 6.8) are within the range of normal background (>4.9) but the specific conductance values (natural background 10 to 1,000 umhos/cm) are almost uniformly elevated (range of 280 to 3,660). The values of specific conductance (1,180 to 3,660 umhos/cm) at Wells MD3-1 through MD3-3 may be due to leachate from the landfill, tidal influence of the adjacent drainage ditch, or a combination of these factors. Specific conductance at Well MD3-4 is probably due to the effects of Irrigation Field No. 4 (Figure 5). DOC values (range of 16 to 80 mg/l) and TOX values (range of 110 to 260 ug Cl^-/l) indicate possible organic contamination of the shallow groundwater. Some of these influences may be due to the spray irrigation fields on and adjacent to the landfill.

Analysis of Wells MD3-2 and MD3-4 for 31 purgeable compounds showed small quantities of two halogenated ethanes and toluene (2 to 11 ug/l), and traces of benzene (Table 11). No PCBs (Table 10) were detected in samples taken at this site. None of these values exceeded the EPA ambient water quality criteria for the compounds in question.

4.3.2.3 Landfills 5-8--The pH values (range 5.1 to 6.6) at these wells (Table 12) are within the range of the natural background for the area (>4.9). Two wells had relatively high specific conductance readings: Well 58-1 at 2,940 umhos/cm and Well 58-4 at 1,970 umhos/cm. The high value at Well 58-1 could be due to tidal influence in the adjacent drainage ditch; however, the specific conductance at Well 58-4 is probably due to leachate. If specific conductance at Well 58-4 were due to tidal influence, then Wells 58-2 and 58-3 would also have high values of specific conductance.

The other GWCI indicate possible organic groundwater contamination. DOC (range of 30 to 62 mg/l), TOX (range of 100 to 240 ug Cl^-/l) and phenolics (range of 6 to 12 ug/l) values all indicate potential organic contamination of groundwater. Phenolics exceed the general surface water criteria for Florida of 1 ug/l.

Table 11. Concentration of Volatile Halocarbons and Volatile Aromatics, Landfill 3, MacDill AFB, November 1983

	MD3-2	MD3-4	Dectection Limit
VOH (all units ug/l)			
Bromodichloromethane	ND	ND	<1
Bromoform	ND	ND	<3
Bromoethane	ND	ND	<5
Carbon tetrachloride	ND	ND	<1
Chlorobenzene	ND	ND	<1
Chloroethane	11	ND	<5
2-Chloroethylvinyl ether	ND	ND	<3
Chloroform	ND	ND	<1
Chloromethane	ND	ND	<1
Dibromochloromethane	ND	ND	<1
1,2-Dichlorobenzene	ND	ND	<1
1,3-Dichlorobenzene	ND	ND	<1
1,4-Dichlorobenzene	ND	ND	<1
Dichlorodifluoromethane	ND	ND	<1
1,1-Dichloroethane	ND	ND	<1
1,1-Dichloroethene	ND	ND	<1
1,2-Dichloroethane	ND	ND	<1
Trans-1,2-Dichloroethene	ND	ND	<1
Cis-1,3-Dichloropropene	ND	ND	<1
Trans-1,3-Dichloropropene	ND	ND	<1
Methylene chloride	ND	ND	<1
Tetrachloroethene	ND	ND	<1
1,1,1-Trichloroethane	2	2	<1
1,1,2-Trichloroethane	ND	ND	<1
Trichloroethene	ND	ND	<1
Trichlorofluoromethane	ND	ND	<1
Vinyl chloride	ND	ND	<1
VOA (all units ug/l)			
Benzene	Trace*	Trace*	<1
Ethyl benzene	ND	ND	<1
Toluene	ND	3	<1
Xylenes	ND	ND	<3

ND = None detected.
*Below detection limit, but peak present.

Table 12. Results of Analyses of Groundwater Collected in the Vicinity of Landfills 5-8, MacDill AFB, November 1983

Parameter	Wells				
	58-1*	58-1*	58-2	58-3	58-4
pH	6.6	NA	5.1	5.6	6.2
Sp. cond. (umhos/cm)**	2,940	NA	785	315	1,970
DOC (mg/l)	45	62	54	30	56
TOX (ug Cl^-/l)	150	†	240	100	120
Phenolics (ug/l)	12	7	8	6	11

NA = Not analyzed.
*Duplicate sample.
**Corrected to 25°C.
†Sample container broken in shipping.

Table 13. Results of Analyses of Groundwater Collected in the Vicinity of Landfill 9, MacDill AFB, November 1983

Parameter	Wells		
	9-1	9-2	9-3
pH	7.0	6.8	6.7
Sp. cond. (umhos/cm)**	6,120	11,300	15,350
DOC (mg/l)	34	53	141
TOX (ug Cl^-/l)	130	†	140
Phenolics (ug/l)	1	5	8

**Corrected to 25°C.
†Sample container broken in shipping.

4.3.2.4 Landfill 9--This site is bordered by an estuarine environment which probably influences groundwater quality (Table 13). The pH (range of 6.7 to 7.0) is within the Florida and EPA drinking water standards (6.5 to 8.5). Specific conductance (range of 6,120 to 15,350 umhos/cm) values may be due to the effects of the adjacent estuarine environment, to leachate from the landfill, or a combination of these factors. The other analyses denote possible organic contamination of the groundwater at each well. Well 9-3 is the most suspect of the three wells at this site with a DOC of 141 mg/l, TOX of 140 ug/l, and total phenolics of 8 ug/l.

4.3.2.5 Site A, Former Fuel Storage Area Adjacent to AGE--Of the four wells installed, only one, MDA4, exhibited visual evidence of fuel contamination. The well immediately adjacent to it, MDA3, had a fuel odor in the pipe casing but no visible fuel layer. The layer of fuel in Well MDA4 was measured by conductivity to be approximately 1.6 feet thick, while a sample taken from the same well with a 1/2-inch plastic tube showed a thickness of 33 1/2 inches. This discrepancy is probably due to capillary action and the tube displacing the fuel.

4.3.2.6 Site 17, Drum Storage Area--Although the pH (5.0 and 5.2), specific conductance (76 and 190 umhos), and DOC (16* and 26 mg/l) values for the two wells at this site (Table 14) are within the probable natural background ranges, there is indication of possible organic contamination from the TOX (130* and 120 ug Cl^-/l) and phenolics (10 and 8 ug/l) values. No PCBs were detected at this site.

4.3.2.7 Site 23, Fire Training Areas--The six wells at this site exhibited pH (range of 6.0 to 6.7) and specific conductance (range of 405 to 810 umhos/cm) values (Table 15) within the expected background ranges for the area (pH >4.9 and specific conductance 10 to 1,000 umhos/cm). Lead was detected at two wells, but the values were close to the detection limit of 30 ug/l and below the MCL of 50 ug/l. DOC (range of 13 to 328 mg/l) and TOX (range of 810 to 5,900 ug Cl^-/l) values indicate organic contamination of the groundwater.

*Average of duplicate values for MD17-1.

Table 14. Results of Analyses of Groundwater Collected in the Vicinity of Site 17--Drum Storage Area, MacDill AFB, November 1983

Parameter	Wells 17-1*	17-1*	17-2
pH	5.0	NA	5.2
Sp. cond. (umhos/cm)**	76	NA	190
DOC (mg/l)	21	11	26
TOX (ug Cl^-/l)	110	150	120
PCBs (ug/l)	<0.25	NA	<0.25
Phenolics (ug/l)	10	NA	8

NA = Not analyzed.
*Duplicate sample.
**Corrected to 25°C.

Table 15. Results of Analyses of Groundwater Collected in the Vicinity of Site 23--Fire Training Areas, MacDill AFB, November 1983

Parameter	Wells 23-1	23-2	23-3*	23-3*	23-4	23-5	23-6
pH	6.2	6.0	6.3	NA	6.7	6.7	6.4
Sp. cond. (umhos/cm)**	550	790	405	NA	565	810	645
Lead (ug/l)	<30	<30	35	<30	<30	<30	38
DOC (mg/l)	48	41	328	NA	13	29	25
TOX (ug Cl^-/l)	1,900	5,900	2,000	NA	940	810	2,400
VCH	NA	NA	***	***	NA	NA	***
VOA	NA	NA	***	***	NA	NA	***

NA = Not analyzed.
*Duplicate sample.
**Corrected to 25°C.
***Refer to Table 16 for results.

Well 23-3 had visible fuel/oil contamination and several alkyl halides (Table 16) were detected as well as large amounts of VOAs (mean range of 25 to 1,900 ug/l). The VOAs from Well 23-3 benzene, ethyl benzene, and toluene all exceed the EPA ambient water quality criteria (0, 1.4, and 14.3 ug/l, respectively). Volatile compounds were also detected at Well 23-6, but only 1,1,1-trichloroethane (32 ug/l) exceeded the EPA ambient criterion of 18.4 ug/l.

4.3.3 Avon Park AFR Sites

4.3.3.1 Landfill AP6, Old Landfill--The DOC (8 to 14 mg/l) and TOX values (range of 110 to 120 ug Cl^-/l) at all three wells and a specific conductance of 1,210 umhos/cm at Well 6-2 indicate possible contamination of the groundwater in this area (Table 17). The pH (range of 5.6 to 6.2) is within the expected natural background ranges (pH >4.9). Lead was not detected in any of three wells.

4.3.3.2 Landfill AP7, Current Landfill--Two parameters at this site indicate possible groundwater contamination by organic material (Table 18). TOX ranged from 40 to 100 ug Cl^-/l and phenolics varied from 10 to 13 ug/l. The pH (range of 5.4 to 6.2), specific conductance (range of 214 to 340 umhos/cm), and DOC (range of <1 to 17 mg/l) values are probably within the natural background ranges for the area. The only pesticides detected were the DDT isomers at a total concentration of 0.03 ug/l, very near the detection limit of 0.02 ug/l.

4.3.3.3 Site AP11, Pesticide Rinse Water Basin--The pH (5.5 at both wells) and specific conductance (135 and 210 umhos/cm) values (Table 19) are within the expected range of natural background. Aldrin was detected at the limit of detection at Station AP11-2, but no other pesticides were detected at this site.

Table 16. Concentration of Volatile Halocarbons and Volatile Aromatics, Site 23--Fire Training Areas, MacDill AFB, November 1983

	MD23-3*	MD23-3*	MD23-6	Dectection Limit
VOH (all units ug/l)				
Bromodichloromethane	ND	ND	ND	<1
Bromoform	ND	ND	3	<3
Bromoethane	ND	ND	ND	<5
Carbon tetrachloride	ND	ND	ND	<1
Chlorobenzene	ND	ND	ND	<1
Chloroethane	ND	ND	ND	<5
2-Chloroethylvinyl ether	ND	ND	ND	<3
Chloroform	ND	ND	Trace**	<1
Chloromethane	ND	ND	ND	<1
Dibromochloromethane	ND	ND	ND	<1
1,2-Dichlorobenzene	ND	ND	ND	<1
1,3-Dichlorobenzene	ND	ND	ND	<1
1,4-Dichlorobenzene	ND	ND	ND	<1
Dichlorodifluoromethane	ND	ND	ND	<1
1,1-Dichloroethane	ND	ND	ND	<1
1,1-Dichloroethene	ND	2	2	<1
1,2-Dichloroethane	ND	ND	ND	<1
Trans-1,2-Dichloroethene	110	164	ND	<1
Cis-1,3-Dichloropropene	ND	ND	ND	<1
Trans-1,3-Dichloropropene	ND	ND	ND	<1
Methylene chloride	ND	180	ND	<1
Tetrachloroethene	ND	ND	ND	<1
1,1,1-Trichloroethane	2	31	32	<1
1,1,2-Trichloroethane	ND	ND	ND	<1
Trichloroethene	96	1	ND	<1
Trichlorofluoromethane	ND	ND	ND	<1
Vinyl chloride	ND	ND	7	<1
VOA (all units ug/l)				
Benzene	33	17	Trace**	<1
Ethyl benzene	109	238	1	<1
Toluene	341	578	ND	<1
Xylenes	1,400	2,400	ND	<3

ND = None detected.
*Duplicates
**Below detection limit, but peak present.

Table 17. Results of Analyses of Groundwater Collected in the Vicinity of Landfill AP6, Avon Park AFR, November 1983

Parameter	Wells 6-1	6-2	6-3
pH	6.2	5.8	5.6
Sp. cond. (umhos/cm)**	464	1,210	180
Lead (ug/l)	<30	<30	<30
DOC (mg/l)	14	8	8
TOX (ug Cl^-/l)	120	110	110

**Corrected to 25°C.

Table 18. Results of Analyses of Groundwater Collected in the Vicinity of Landfill AP7, Avon Park AFR, November 1983

Parameter	Wells 7-1	7-2	7-3*	7-3*
pH	6.2	5.4	6.1	NA
Sp. cond. (umhos/cm)**	340	214	318	NA
DOC (mg/l)	17	17	<1	<1
TOX (ug Cl^-/l)	90	100	40	40
Phenolics (ug/l)	10	13	12	10
Organochlorine Pesticides (ug/l)				
Aldrin	<0.02	<0.02	<0.02	<0.02
DDT isomers	<0.02	<0.02	<0.02	0.03
Dieldrin	<0.02	<0.02	<0.02	<0.02
Endrin	<0.02	<0.02	<0.02	<0.02
Heptachlor	<0.02	<0.02	<0.02	<0.02
Heptachlor epoxide	<0.02	<0.02	<0.02	<0.02
Lindane	<0.01	<0.01	<0.01	<0.01
Methoxychlor	<0.20	<0.20	<0.20	<0.20

NA = Not analyzed.
*Duplicate sample.
**Corrected to 25°C.

Table 19. Results of Analyses of Groundwater Collected in the Vicinity of Site AP11--Pesticide Rinse Water Basin, Avon Park AFR, November 1983

Parameter	Wells 11-1	Wells 11-2
pH	5.5	5.5
Sp. cond. (umhos/cm)*	135	210
Organochlorine Pesticides (ug/l)		
Aldrin	<0.02	0.02
DDT isomers	<0.02	<0.02
Dieldrin	<0.02	<0.02
Endrin	<0.02	<0.02
Heptachlor	<0.02	<0.02
Heptachlor epoxide	<0.02	<0.02
Lindane	<0.01	<0.01
Methoxychlor	<0.20	<0.20

*Corrected to 25°C.

4.4 SIGNIFICANT FINDINGS

4.4.1 Introduction

In discussing the significance of the results of this study, it is important to recognize the limitations of the data. Most important is the difficulty of drawing conclusions from a set of data that represent a single point in time. Long-term data should, in the future, put the present data in much better perspective. The lack of a background monitor well leaves doubt about natural background concentrations of various constituents, especially general indicators (DOC and TOX) which are not commonly reported in the groundwater literature pertaining to central Florida. Furthermore, natural background water quality can be influenced by proximity to brackish surface water, the tidal cycle, and seasonal variations. The remaining limitation of the present data is the heavy reliance on screening analyses which measure a given class of compounds (e.g., phenolics). This has the advantage of screening for a variety of compounds for a relatively low price; however, a positive result for any of the screening analyses is more difficult to evaluate than results of analyses for specific compounds or ions.

4.4.2 MacDill AFB Sites

4.4.2.1 Site 16, Fuel Tank Farm--Surface water in drainage ditches adjacent to this site (Figures 2 and 4) appear to be tidal; consequently these waters are subject to both the general surface water criteria and Class II surface water criteria described in Section 4.1.3 and Table 7. Comparison of the analytical results for Site 16 (Table 9) with the Florida Water Quality Criteria (FWQC) and with the MCLs for drinking water (Table 6) indicates that:

1. Oil and grease contamination of groundwater at Site 16 threatens adjacent surface waters since groundwater from four stations (5.9* to 39.0 ug/l) exceeds the surface water criterion of 5.0 mg/l of dissolved or emulsified oils and greases.
2. Lead concentrations of groundwater at Site 16 (<30 ug/l to 40 ug/l) do not exceed either the MCL for groundwater or the FWQC (50 ug/l).
3. Specific conductance and pH clearly meet applicable groundwater standards and surface water criteria at every station except

*Average of duplicate values (10.2 and 1.6 ug/l).

MD16-4, where specific conductance is 1,950 umhos/cm. This specific conductance is probably due to tidal influences since this station is closest to brackish water and the suspected contaminants at this site (fuel) would not cause high values of specific conductance.

4.4.2.2 Landfill 3, Landfill at Dog Kennel--Applicable surface water criteria for this site are the general criteria for pH and specific conductance and those for Class II surface waters (Table 7). None of the other standards in Tables 6 and 7 are on the list of analyses for this site (Table 4).

1. The values of specific conductance (1,180 to 3,660 umhos/cm) at Wells MD3-1 through MD3-3 may be due to leachate from the landfill, tidal influence of the adjacent drainage ditch, or a combination of these factors. Specific conductance at Well MD3-4 is probably due to the effects of Irrigation Field No. 4 (Figure 5).
2. DOC (16 to 58 mg/l) and TOX (110 to 260 ug Cl /l) in Wells MD3-1 through MD3-4 indicate that groundwater contamination at Landfill 3 may pose a threat to adjacent surface water. The values of TOX in Wells MD3-2 and MD3-4 are far greater than the total VOH detected in these two wells (13 and 2 ug/l, respectively) which indicates that TOX is attributable to additional organohalides.
3. PCBs were below detection limits at all wells associated with Landfill 3.

4.4.2.3 Landfills 5-8--Surface waters adjacent to these landfills are also tidal (Figure 6) and are thus subject to both general surface water criteria and Class II surface water criteria (Table 7).

1. Specific conductance at Well MD58-4 (1,970 umhos/cm) is probably due to leachate from Landfill 8 and not to tidal effects, since the next two wells downstream (MD58-3 and MD58-2) have much

lower values of specific conductance (315 and 785 umhos/cm, respectively).

2. All wells had concentrations of DOC (30 mg/l to 62 mg/l) and TOX (100 ug Cl^-/l to 240 ug Cl^-/l) which indicate potential organic contamination of groundwater.
3. The concentration of phenolics in Wells MD58-1 through MD58-4 (6 to 12 ug/l) is higher than the general surface water criterion of 1 ug/l for chlorinated phenolics.
4. All of the above conditions indicate that Landfills 5-8 may threaten adjacent surface waters.

4.4.2.4 Landfill 9--This site is adjacent to Broad Creek (Figure 7) which is subject to the same criteria as waters adjacent to Landfills 5-8.

1. Specific conductance of groundwater from all three wells at Landfill 9 (6,120 to 15,350 umhos/cm) may be a result of landfill leachate, brackish water from Broad Creek, or a combination of these factors. However, the increasing specific conductance from Wells MD9-1 to MD9-3 (i.e., from upstream to downstream) indicates that the major component of specific conductance in these wells is attributable to salt water intrusion from Broad Creek.
2. Concentrations of phenolics (1 to 8 ug/l) and DOC (34 to 141 mg/l) are also of uncertain origin, but they both follow the pattern of increasing from Wells MD9-1 to MD9-3. As discussed earlier, both of these analyses are used as general indicators of contamination; however, neither analysis differentiates between synthetic organic chemicals and naturally occurring products of the decay of organic matter (see Table 7, phenolics compounds). The mangrove swamp on the south side of MacDill AFB (Figure 2) is, of course, a rich source of decaying organic material. As with specific conductance, the increases of phenolics and DOC from Wells MD9-1 to MD9-3 indicate that the

major component of both factors is the adjacent surface water environment.

3. TOX concentrations (130 to 140 ug $Cl^{-}/1$) in wells at Landfill 9 indicate possible contamination of groundwater from halogenated synthetic organic compounds.

4.4.2.5 Site A, Former Fuel Storage Area Adjacent to AGE--Hillsborough Bay is approximately 1,500 feet northeast of Site A (Figures 2 and 8) and is subject to both general surface water criteria and Class III surface water criteria (Table 7).

1. Measurements taken in Wells MDA-1 through MDA-4 indicate that the layer of fuel contamination from Site A is migrating from the site toward Hillsborough Bay (Figure 8). This is consistent with the direction of flow indicated by water level contours in Figure 17. Since Well MDA-3 has a fuel odor but no measureable fuel layer, it is presumably at the limit of the lens of fuel. Well MDA-4 is within the area of the lens of fuel since it had approximately 1.6 feet of fuel floating on the groundwater surface. If Well MDA-4 is presumed to be in the center of the lens of fuel, one may approximate the minimum quantity of fuel in the lens by assuming that:
   a. The lens has the form of an inverted, right circular cone with a radius of 51 feet and a height of 1.6 feet; and
   b. Average soil porosity is 0.35 (Davis, 1969). In this case, the approximate volume of fuel would be 1,510 cubic feet (11,295 gallons).
2. Fuel odors in soil samples taken from below the water table in Well MDA-4 (see well logs, Appendix D) indicate that groundwater at Site A is contaminated by dissolved fuel components.

4.4.2.6 Site 17, Drum Storage Area--This site is adjacent to the western boundary of MacDill AFB (Figures 2 and 9). Results of analyses for this site (Table 14) indicate:

1. No contamination attributable to PCBs, pH, or specific conductance; and
2. Possible organic contamination of groundwater attributable to DOC (16* and 26 mg/l), TOX (120 and 130* ug Cl^-/l), and phenolics (8 and 10 ug/l).

Groundwater flow at Site 17 is westerly toward the base boundary (Figure 17); therefore, the possible organic contamination detected in Wells MD17-1 and MD17-2 threatens the off-base water table aquifer.

4.4.2.7 Site 23, Fire Training Areas--Both fire training areas are in the central portion of the base (Figures 2 and 10), approximately 1 mile from Tampa Bay and about 1/2 mile from the base boundary. Analyses of groundwater at Site 23 (Tables 15 and 16) revealed the following:

1. Organic contamination of groundwater was detected in all six wells; VOH and VOA (Table 16) account for only a fraction of the TOX (810 to 5,900 ug Cl^-/l)and DOC (13 to 328 mg/l) concentrations. Some of this organic contamination may be attributable to the use of aqueous film forming foam (AFFF) in fire training at these areas. AFFF is a fluorocarbon surfactant with a chemical oxygen demand (COD) of 40,000 mg/l. Data are not available on the hazardous or toxic properties of AFFF and its degradation products.
2. Lead contamination in all wells at Site 23 is below the MCL for lead in Table 6 (50 ug/l).
3. Specific conductance and pH are within expected normal background ranges.

Brown (1982) has reported that organic solvents may increase the hydraulic conductivity of clay strata. If the solvents detected in

*Average of duplicate values (21 and 11 ug/l) for Well MD17-1.

groundwater at Site 23 have this effect on the clay confining bed underlying the site, recharge of the Floridan Aquifer would be increased. Therefore, this site threatens water quality and may violate groundwater quality standards in the Floridan Aquifer (see Section 4.1.1).

4.4.3 Avon Park AFR Sites

4.4.3.1 Landfill AP6, Old Landfill--This site is bisected by a drainage ditch which flows west to Arbuckle Creek (Figure 3). Both the ditch and Arbuckle Creek are Class III waters. The data in Table 17 indicate:

1. Concentrations of TOX (110 to 120 ug Cl^-/l) and DOC (8 to 14 mg/l) indicate potential contamination of groundwater in all three wells at this site.
2. Specific conductance at Well AP6-2 (1,210 umhos/cm) is much higher than specific conductance in the other wells at Landfill 6 (180 and 464 umhos/cm). This may be due to leachate from Landfill 6, but may also be caused by a nearby stock handling pen.
3. Lead concentrations (<30 ug/l) and pH (5.6 to 6.2) are both within the MCLs for drinking water (<50 ug/l lead and pH >4.9).

4.4.3.2 Landfill AP7, Current Landfill--Groundwater from Landfill AP7 may be expected to flow toward the rim canal; although the major direction of groundwater flow is toward Arbuckle Creek (Figure 18). Results of analyses of groundwater from this site (Table 18) indicate:

1. Potential contamination of groundwater by organics. Phenolics (11* to 13 ug/l) and TOX (40 to 100 ug Cl^-/l) were above the levels of concern (1 ug/l and 40 ug Cl^-/l, respectively) in all three wells. DOC concentrations were 17 mg/l in Wells AP7-1 and AP7-2.
2. The organochlorine pesticide analyses reveal no significant contamination.

*Average of duplicate values (10 and 12 ug/l) for AP7-3.

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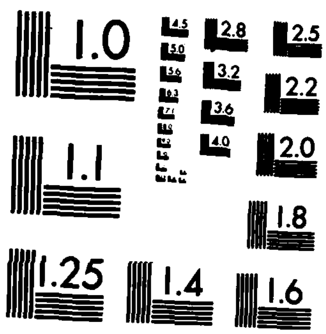
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1.4
1.6

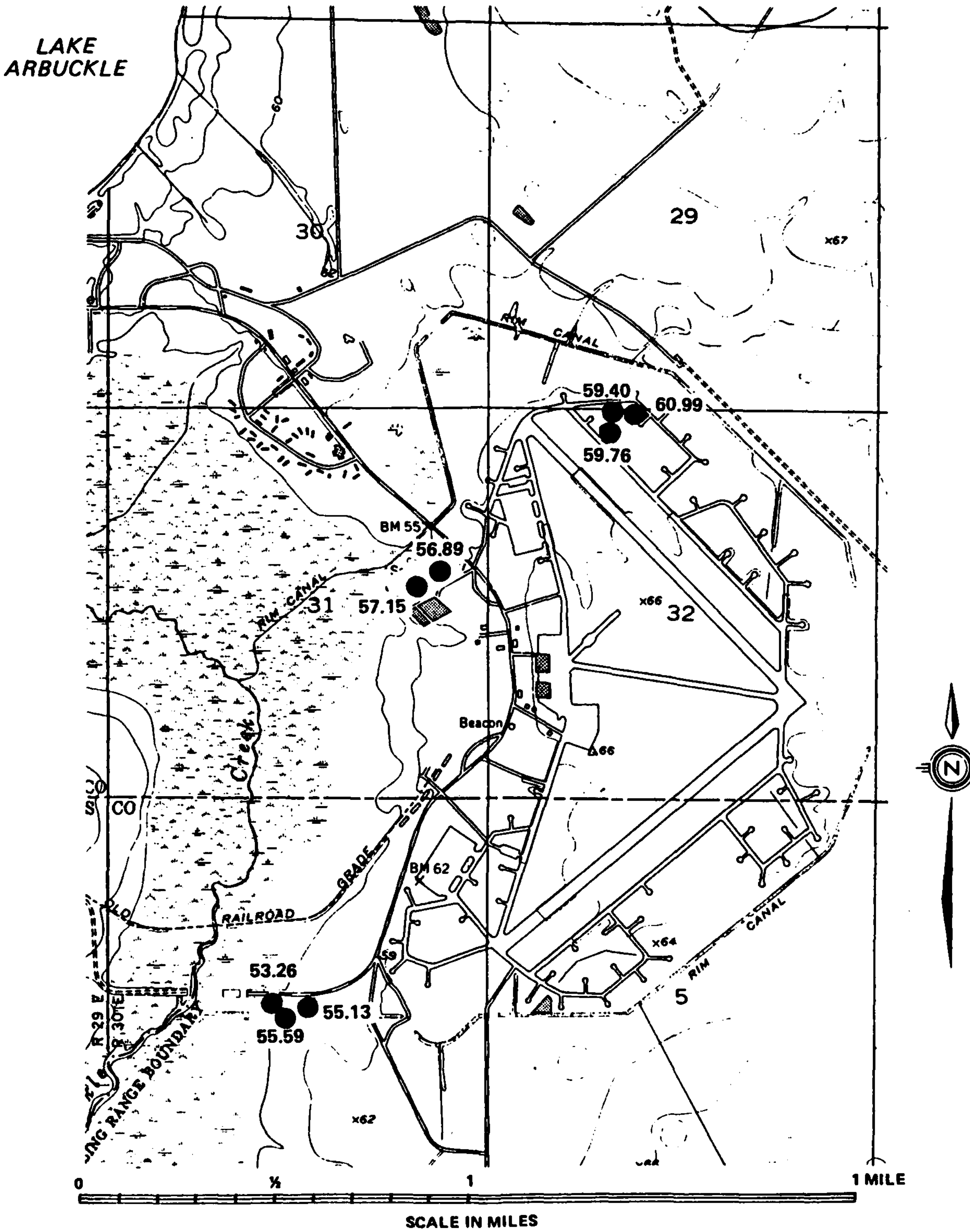

FIGURE 18. Water Table Elevations at Avon Park AFR, October 1983

BASE MAP: U. S. Geological Survey. 1972. Lake Arbuckle NE, Florida. (7.5' Topographic Map).

3. Specific conductance and pH are within expected background levels.

4.4.3.3 Site AP11, Pesticide Rinse Water Basin--There was no significant contamination attributable to the parameters investigated in this study.

4.5 SITE B, FORMER FUEL STORAGE AREA NO. 2

During the course of the Phase IIb study, Capt. Pailthorp (MacDill AFB bioenvironmental engineer) advised WAR that there was a second underground fuel storage area that is no longer used. This area, Site B, is on the southeastern limb of the flight line (Figures 2 and 19). Additional information concerning Site B was furnished by Capt. Newberry who is Capt. Pailthorp's successor as MacDill AFB bioenvironmental engineer. This information reveals that Site B consists of 12 25,000-gallon and one 12,000-gallon underground tanks with associated piping. It was in operation from the early 1950's until 1972. Generally, underground tanks begin to leak after approximately 15 years service (Winegardner, 1984); therefore, Site B is a potential source of groundwater contamination.

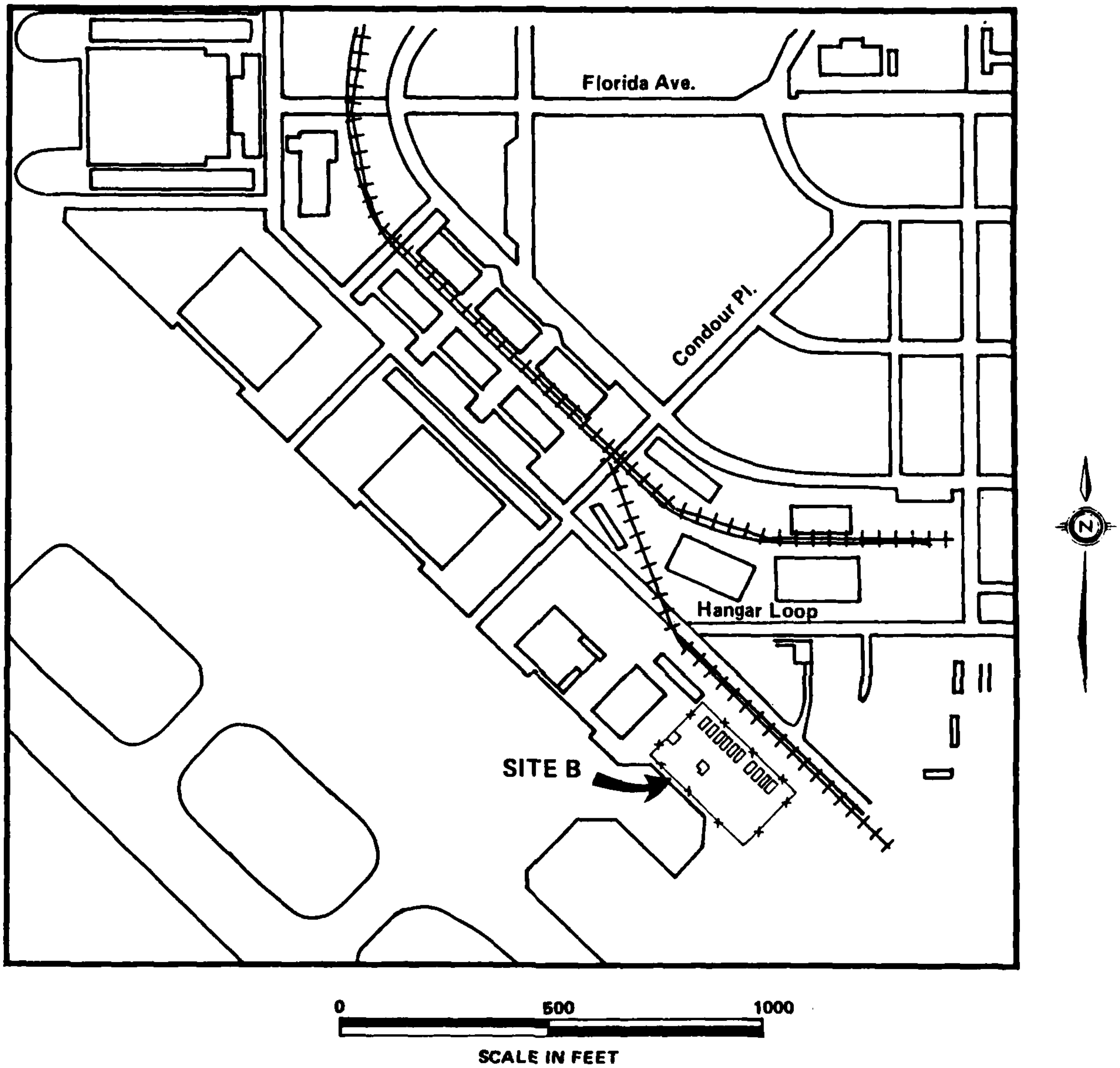

FIGURE 19. Detail of Site B, Former Fuel Storage Area No. 2, MacDill AFB, Florida

5.0 ALTERNATIVE MEASURES

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Most of the evidence of groundwater contamination at MacDill AFB and Avon Park AFR is from general screening analyses. As discussed earlier, these analyses have the advantage of relatively low cost, but they do not identify specific compounds. Analyses for phenolics and DOC measure classes of compounds, portions of which are synthetic organic compounds and portions of which are the result of the natural decay of organic matter. TOX is a measure of total halogenated organic compounds which are mostly synthetic. This method was originally developed as a screening analysis for drinking water (Harper, 1984; Dressman, 1984) and has since been required for groundwater monitoring at hazardous waste sites by EPA. In the latter application, TOX is subject to positive matrix interferences.

A conservative attitude in matters of environmental safety requires that positive results be investigated via expanded sets of analyses. Indications of organic contamination of groundwater require analyses for purgeable organics, base/neutral extractable organic compounds, and acid extractable organic compounds which are three groups of the EPA Priority Pollutant List (Table 20). Analyses for TOX and phenolics should be included for a mass-balance comparison with halogenated organics and the acid extractable organics, respectively. The expanded set of analyses for organics need not include pesticides or PCBs since the analyses in this study detected insignificant quantities of pesticides and no PCBs. High values of specific conductance in groundwater that do not correlate with adjacent brackish water should be assumed to represent leachate; consequently analyses for such sites should be expanded to include the metals section of Table 20.

Data from Site A give clear evidence of a lens of fuel floating on the groundwater surface, but the four monitor wells at this site (MDA1 through MDA4) are too few to adequately define the volume and areal extent of the free-floating fuel product. The odor of soil samples from

Table 20. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters* (Page 1 of 4)

Percent of Samples†	Number of Industrial Categories**	Parameter
31 are purgeable organics		
1.2	5	Acrolein
2.7	10	Acrylonitrile
29.1	25	Benzene
29.3	28	Toluene
16.7	24	Ethylbenzene
7.7	14	Carbon tetrachloride
5.0	10	Chlorobenzene
6.5	16	1,2-Dichloroethane
10.2	25	1,1,1-Trichloroethane
1.4	8	1,1-Dichloroethane
7.7	17	1,1-Dichloroethylene
1.9	12	1,1,2-Trichloroethane
4.2	13	1,1,2,2-Tetrachloroethane
0.4	2	Chloroethane
1.5	1	2-Chloroethyl vinyl ether
40.2	28	Chloroform
2.1	5	1,2-Dichloropropane
1.0	5	1,3-Dichloropropene
34.2	25	Methylene chloride
1.9	6	Methyl chloride
0.1	1	Methyl bromide
1.9	12	Bromoform
4.3	17	Dichlorobromomethane
6.8	11	Trichlorofluoromethane
0.3	4	Dichlorodifluoromethane
2.5	15	Chlorodibromomethane
10.2	19	Tetrachloroethylene
10.5	21	Trichloroethylene
0.2	2	Vinyl chloride
7.7	18	1,2-trans-Dichloroethylene
0.1	2	bis (Chloromethyl) ether
46 are base/neutral extractable organic compounds		
		1,2-Dichlorobenzene
6.0	9	1,3-Dichlorobenzene
		1,4-Dichlorobenzene
0.5	5	Hexachloroethane
0.2	1	Hexachlorobutadiene

Table 20. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters* (Page 2 of 4)

Percent of Samples†	Number of Industrial Categories**	Parameter
1.1	7	Hexachlorobenzene
1.0	6	1,2,4-Trichlorobenzene
0.4	3	bis (2-Chloroethoxy) methane
10.6	18	Naphthalene
0.9	9	2-Chloronaphthalene
1.5	13	Isophorone
1.8	9	Nitrobenzene
1.1	3	2,4-Dinitrotoluene
1.5	9	2,6-Dinitrotoluene
0.04	1	4-Bromophenyl phenyl ether
41.9	29	bis (2-Ethylhexyl) phthalate
6.4	12	Di-n-octyl phthalate
5.8	15	Dimethyl phthalate
7.6	20	Diethyl phthalate
18.9	23	Di-n-butyl phthalate
5.7	11	Fluorene
7.2	12	Fluoranthene
5.1	9	Chrysene
7.8	14	Pyrene
10.6	16	Phenanthrene
		Anthracene
2.3	6	Benzo(a)anthracene
1.6	6	Benzo(b)fluoranthene
1.8	6	Benzo(k)fluoranthene
3.2	8	Benzo(a)pyrene
0.8	4	Indeno(1,2,3-c,d)pyrene
0.2	4	Dibenzo(a,h)anthracene
0.6	7	Benzo(g,h,i)perylene
0.1	2	4-Chlorophenyl phenyl ether
0	0	3,3'-Dichlorobenzidine
0.2	4	Benzidine
1.1	4	bis(2-Chloroethyl) ether
0.8	7	1,2-Diphenylhydrazine
0.1	1	Hexachlorocyclopentadiene
1.2	5	N-Nitrosodiphenylamine
4.5	12	Acenaphthylene
4.2	14	Acenaphthene
8.5	13	Butyl benzyl phthalate

Table 20. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters* (Page 3 of 4)

Percent of Samples†	Number of Industrial Categories**	Parameter
0.1	1	N-Nitrosodimethylamine
0.1	2	N-Nitrosodi-n-propylamine
1.4	6	bis(2-Chloroisopropyl) ether
11 are acid extractable organic compounds		
26.1	25	Phenol
2.3	11	2-Nitrophenol
2.2	9	4-Nitrophenol
1.6	6	2,4-Dinitrophenol
1.1	6	4,6-Dinitro-o-cresol
6.9	18	Pentachlorophenol
1.9	8	p-Chloro-m-cresol
2.3	10	2-Chlorophenol
3.3	12	2,4-Dichlorophenol
4.6	12	2,4,6-Trichlorophenol
5.2	15	2,4-Dimethylphenol
26 are pesticides/PCBs		
0.3	3	α-Endosulfan
0.4	4	β-Endosulfan
0.2	2	Endosulfan sulfate
0.6	4	α-BHC
0.8	6	β-BHC
0.2	4	δ-BHC
0.5	3	γ-BHC
0.5	5	Aldrin
0.1	3	Dieldrin
0.04	1	4,4'-DDE
0.1	2	4,4'-DDD
0.2	2	4,4'-DDT
0.2	3	Endrin
0.2	2	Endrin aldehyde
0.3	3	Heptachlor
0.1	1	Heptachlor epoxide
0.2	4	Chlordane
0.2	2	Toxaphene
0.6	2	Arochlor 1016

Table 20. EPA List of 129 Priority Pollutants and the Relative Frequency of these Materials in Industrial Wastewaters* (Page 4 of 4)

Percent of Samples†	Number of Industrial Categories**	Parameter
0.5	1	Aroclor 1221
0.9	2	Aroclor 1232
0.8	3	Aroclor 1242
0.6	2	Aroclor 1248
0.6	3	Aroclor 1254
0.5	1	Aroclor 1260
---	--	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
13 are metals		
18.1	20	Antimony
19.9	19	Arsenic
14.1	18	Beryllium
30.7	25	Cadmium
53.7	28	Chromium
55.5	28	Copper
43.8	27	Lead
16.5	20	Mercury
34.7	27	Nickel
18.9	21	Selenium
22.9	25	Silver
19.2	19	Thallium
54.6	28	Zinc
Miscellaneous		
33.4	19	Total cyanides
Not available		Asbestos (fibrous)
Not available		Total phenols

*NRDC Consent Agreement and Committee Print 95-30. 1977. Data Relating to H.R. 3199 (Clean Water Act of 1977). Committee on Public Works and Transportation, 95th Congress, 1st Session. Government Printing Office.

†The percent of samples represents the number of times this compound was found in all samples in which it was analyzed for divided by the total as of 31 August 1978. Numbers of samples ranged from 2,532 to 2,998 with the average being 2,617.

**A total of 32 industrial categories and subcategories were analyzed for organics and 28 for metals as of 31 August 1978.

below the water table at Well MDA4 indicates possible contamination of groundwater by dissolved fuel components.

Operations at Site 23 have produced groundwater contamination at both fire training areas. Some of this contamination is attributable to purgeable organics (solvents), but there is additional organic contamination indicated by analyses for TOX and DOC. At least some of the non-solvent contamination is probably attributable to AFFF and its breakdown products. The presence of organic solvents in groundwater at Site 23 may increase the leakance through the Hawthorne Formation reported by Moccia et al. (1981) and consequently may threaten groundwater quality in the Floridan Aquifer.

Oil and grease concentrations in groundwater at Site 16 are higher than the general surface water criteria for adjacent surface waters.

Results of analyses for nonspecific indicators of groundwater contamination were positive at some or all stations at Landfills 3, 5-8, and 9 and Sites 17, AP6, and AP7.

A second former fuel storage area (Site B) has been identified as worthy of investigation.

6.2 RECOMMENDATIONS

This section presents recommendations for Phase IIc, Phase III, and Phase IV work at MacDill AFB and Avon Park AFR on a site-by-site basis. Rough cost estimates are included for each site to assist the USAF in setting priorities for implementing these recommendations.

6.2.1 Site A, Former Fuel Storage Area Adjacent to AGE

Additional work at this site should include:

1. Define the areal extent and volume of free-floating fuel product with additional observation wells. Prior to well installation, determine the precise locations of the underground tanks and pipes at Site A by geophysical methods.

2. Analyze groundwater from Site A for lead, oil and grease, and VOA.

6.2.2 Site 23, Fire Training Areas

Key issues at these sites are water quality in the Floridan Aquifer and determining which constituents cause the high values of TOX reported in Table 15. Accordingly, WAR recommends the following actions:

1. Install one well into the Floridan Aquifer near the southern fire training area. It is important that construction of this well not create a conduit for the migration of contamination from the water table aquifer to the Floridan Aquifer. Therefore, construct the well in the following manner:
   a. Drill a 12-inch borehole to the top of the clay confining bed;
   b. Install and grout an 8-inch inside diameter (ID) steel pit casing;
   c. Thoroughly wash all down-hole tools and remove all fluid from the pit casing after the grout cures;
   d. Drill an 8-inch borehole to the top of the Floridan Aquifer;
   e. Install and grout a 4-inch ID casing;
   f. Wash all down-hole tools after the grout cures;
   g. Advance a 4-inch borehole to the first producing zone in the Floridan Aquifer, and
   h. Develop the well.
2. Sampling and analysis of the wells should proceed in two stages:
   a. Analyze groundwater from Wells MD23-3 and MD23-6 for TOX, phenolics, purgeable organics, base/neutral extractable organics, acid extractable organics, pH, and specific conductance. The base/neutral extracts should be examined for the 46 base/neutral extractable compounds in Table 20 and for AFFF components and breakdown products.

b. Analyze groundwater from all seven wells for contaminants identified in the previous stage.

Groundwater contamination at both the former and the present fire protection training areas indicates a need to develop environmentally safe training areas. WAR has been informed that the USAF recognizes this need and is working toward this goal.

6.2.3 Site 16, Fuel Tank Farm

Oil and grease concentrations in Table 9 indicate that groundwater from this site could cause adjacent surface water to violate general surface water quality criteria. This may be checked by analyzing an upstream water sample and a downsteam water sample for oil and grease.

6.2.4 Site B, Former Fuel Storage Area No. 2

Field studies of Site B should include:

1. Determine the precise locations of underground tanks and pipes by geophysical methods.
2. Install observation wells to determine if free-floating fuel product is present.
3. Analyze groundwater from Site B for lead, oil and grease, and VOA.

6.2.5 Recommendations for Other Sites

Recommendations for Landfills 3, 5-8, and 9, and Sites 17, AP6, and AP7 are similar. WAR recommends analyzing groundwater from each of the wells at these sites for purgeable organics, acid extractable organics, base/neutral extractable organics, TOX, phenolics, pH, and specific conductance. In addition, groundwater from Wells MD58-4 and AP6-2 should be analyzed for the metals listed in Table 20 to determine if these metals are a significant component of specific conductance measured at these wells. Measure pH and specific conductance of surface water adjacent to monitor wells.

6.2.6 Recommended Frequency of Analysis

The above recommendations are for a one-time sampling and analysis effort. Sampling beyond the one-time effort should be defined on the basis of the results of the analyses recommended in Sections 6.2.1 through 6.2.5.

7.0 REFERENCES

7.0 REFERENCES

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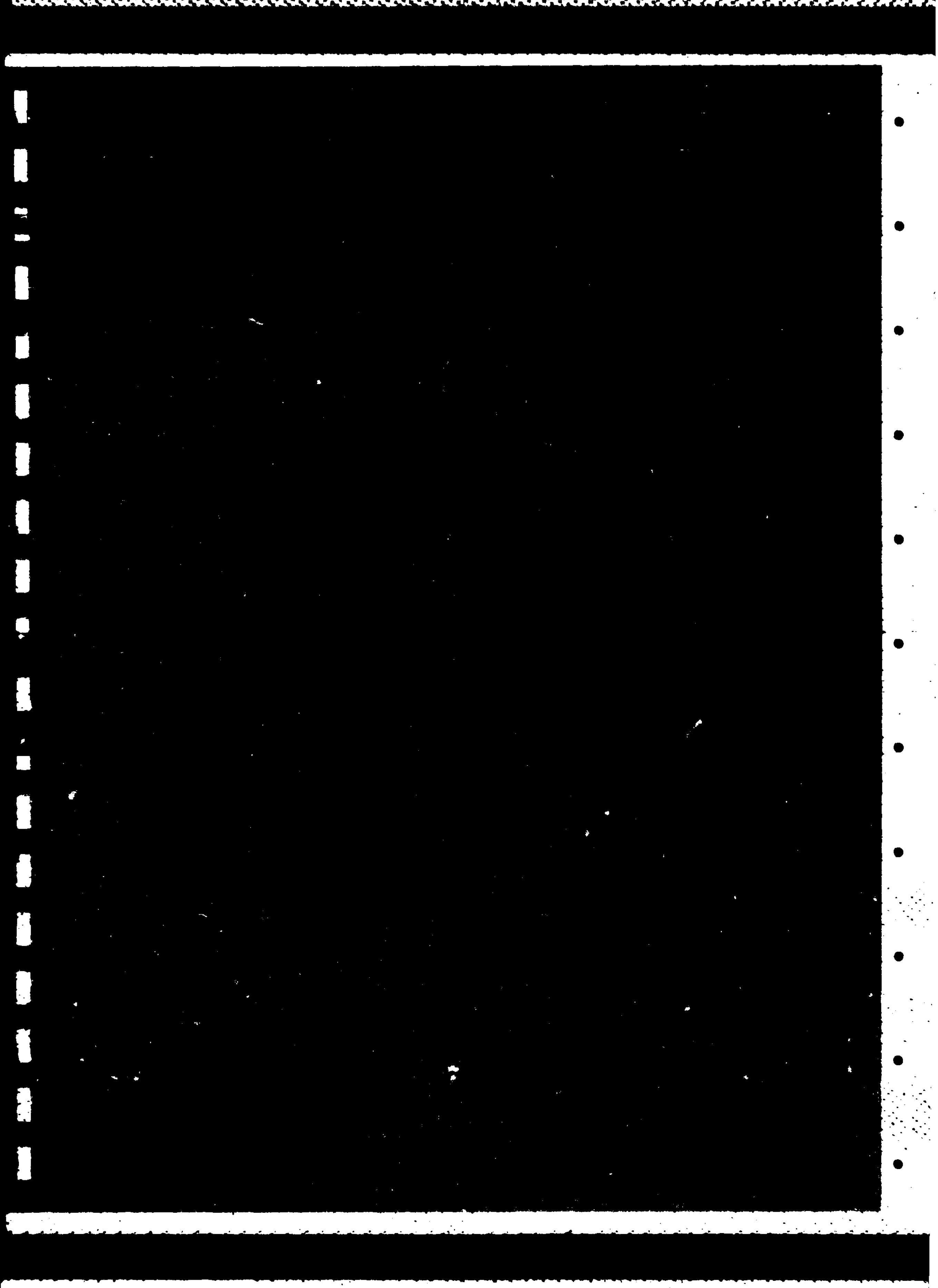

APPENDIX A

LIST OF ACRONYMS

LIST OF ACRONYMS

AGE	Aerospace Ground Equipment
AFB	Air Force Base
ASTM	American Society for Testing Materials
AFFF	Aqueous film forming foams
AFR	Air Force Range
avgas	Aviation gasoline
BOD	Biochemical oxygen demand
cm	Centimeter
Cl^-/l	Chloride per liter
COD	Chemical oxygen demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	Department of Defense
DDT	Dichloro-diphenyl-trichloro-ethane
DOC	Dissolved organic carbon
FAC	Florida Administrative Code
FDER	Florida Department of Environmental Regulation
FWQC	Florid Water Quality Criteria
FWQS	Florida Water Quality Standards
gpd/ft^2	Gallons per day per square foot
GWCI	Groundwater contamination indicators
HARM	Hazardous assessment rating methodology
ICP	Inductively Coupled Plasma Spectrometry
ID	Inside diameter
IRP	Installation Restoration Program
MCL	Maximum contaminant level
msl	Mean sea level
m	Meter
ug/kg	Micrograms per kilogram
ug/l	Micrograms per liter
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
OD	Outside diameter
OEHL	Occupational and Environmental Health Laboratory
PCB	Polychlorinated biphenyl
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
SAC	Strategic Air Command
TAC	Tactical Air Command
TDS	Total dissolved solids
THM	Trihalomethanes
TSI	Technical Services, Inc.
TOC	Total organic carbon
TOX	Total organic halogens
USAF	United States Air Force
EPA	U.S. Environmental Protection Agency
umhos	Micromhos
VOA	Volatile aromatics
VOH	Volatile halocarbons
WAR	Water and Air Research, Inc.

APPENDIX B

SCOPE OF WORK

INSTALLATION RESTORATION PROGRAM

Phase IIB Field Evaluation

MacDill AFB, Florida

Avon Park Air Force Range, Florida

I. Description of Work

The purpose of this task is to determine if environmental contamination has resulted from waste disposal practices at MacDill AFB FL and Avon Park AFR FL; to provide estimates of the magnitude and extent of contamination, should contamination be found; to identify any additional investigations and their attendant costs necessary to identify the magnitude, extent and direction of movement of discovered contaminants.

The presurvey report (Task Order 7 of this contract, mailed under separate cover) and Phase I IRP report (mailed under separate cover) incorporated background and description of the sites for this task. To accomplish the survey effort, the contractor shall take the following steps:

A. General

1. Determine the areal extent of each zone by reviewing available aerial photos of the base, both historical and the most recent panchromatic and infrared. Aerial photographs will be furnished by the Air Force.

2. Water sampling shall be accomplished only once at each location.

3. All water samples shall be analyzed on site by the contractor for pH, and specific conductance. Sampling, maximum holding time and preservation of samples shall strictly comply with the following references: <u>Examination of Water and Wastewater</u>, 15th Ed. (1980), pp. 35-42; <u>ASTM</u>, Part 31, pp. 76-86, (1980), Method D-3370; and <u>Methods for Chemical Analysis of Waters and Wastes</u>, EPA Manual 600/4-79-020, pp. xiii to xix (1979) or latest revision. Detection limits for sample analyses enumerated in Atch 1 shall be strictly adhered to.

4. All wells shall be developed, water levels measured and locations surveyed and recorded on a project map and specific zone map. Groundwater monitoring wells shall as a minimum comply with Environmental Protection Agency guidelines and State of Florida requirements for monitoring well installation. Only screw type joints shall be used. No glue fittings are permitted.

5. Field data collected for each zone shall be plotted and mapped. The nature of contamination and the magnitude and potential for contaminant flow within each zone to receiving streams and groundwaters shall be determined or estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R&D Status report as specified in Item VI below.

6. All water samples collected shall be shipped under refrigeration to the contractor laboratory for subsequent analyses. All water samples shall be analyzed by the contractor for pH and specific conductance in the field at the time of collection.

7. Pesticide analysis where specified shall include analysis for aldrin, DDT isomer, dieldrin, endrin heptachlor, heptachlor epoxide, lindane and methoxychlor. Analysis shall be accomplished in accordance with EPA Method 608.

B. In addition to items delineated in A above, conduct the following specific actions at sites identified on MacDill AFB and Avon Park Air Force Range.

1. Site 16. Fuel Tank Farm - MacDill

a. Install eight pit wells two feet below groundwater surface at the site to determine if fuel is present in the groundwater.

b. Visually examine soil strata to determine if fuel contamination is present.

c. Collect and analyze one water sample from each of the four of the excavations for oil and grease content and lead.

2. Site 3. Landfill at Dog Kennel - MacDill

a. Install a total of 3 groundwater monitoring wells 15 feet deep. At least one well shall be installed on the south side of the landfill and one on the west side of the landfill. The third well shall be installed at a location determined in the field.

b. Collect one sample from each contractor installed well and from each of two existing wells adjacent to the spray irrigation field to the east of the landfill.

c. Analyze each water sample collected for total organic carbon (TOC), total organic halogen (TOX) and PCB's. Analyze two of the five samples collected for volatile halocarbons.

3. Zone 3. Sites 5, 6, 7 and 8 - Past Landfills - MacDill

a. Install four wells 15 feet deep along the drainage canal and edge of fill adjacent to the mangrove swamps. Collect one water sample from each well.

b. Analyze each groundwater sample collected for total organic carbon (TOC), total organic halogen (TOX) and phenol.

4. Site 9. Current Landfill - MacDill

a. Install three 20 foot wells at this location. At least one well shall be installed on the west side of the landfill and at least one well

shall be installed on the south side of the landfill. The third well shall be installed at a location near the landfill selected by the contractor. Collect one water sample from each well.

b. Analyze each sample collected for Total Organic Carbon (TOC), total organic halogen (TOX) and phenol.

5. Site A. Former Fuel Storage Area Adjacent to AGE - MacDill

Install four 10 feet deep augered wells adjacent to the site. Use transparent bailers to collect one groundwater sample from each well. Estimate the quantity of fuel present on the surface of the groundwater.

6. Site 17. Drum Storage Area - MacDill

a. Install two monitoring wells 20 feet deep west of the site near and east of he surface drainage swales.

b. Collect one groundwater sample from each well.

c. Analyze each sample for total organic carbon (TOC), total organic halogen (TOX), PCBs and phenolic compounds.

7. Site 23. Fire Training Areas - MacDill

a. Install six groundwater monitoring wells 20 feet deep around the perimeter of the fire training areas.

b. Collect one groundwater sample from each well.

c. Analyze each sample for total organic carbon (TOC), total organic halogen (TOX) and lead.

In addition analyze two of the six samples for volatile aromatics and volatile halocarbons by using GC techniques.

8. Site AP-6. Old Landfill - Avon Park

a. Install three wells 15 feet deep. One well shall be located on each side of the drainage creek at the site and one well shall be located to the west of the site.

b. Collect one groundwater sample from each well.

c. Analyze each sample collected for total organic carbon (TOC), total organic halogen (TOX) and lead.

In addition analyze two of the six samples for volatile aeromatics and volatile halocarbons by using GC techniques.

9. Site AP-7. Current Landfill - Avon Park

a. Install three wells 15 feet deep. One well shall be installed along the northern boundary of the site. The second well shall be installed along the western boundary of the site. The third well shall be installed along the eastern boundary of the site.

b. Collect one water sample from each well.

c. Analyze each sample for total organic carbon (TOC) total organic halogen, phenol and organochlorine pesticides.

10. Site AP-11. Pesticide Rinsewater Basin - Avon Park

a. Install two groundwater monitoring wells 10 feet deep. One well shall be located to the west of the facility and one well to the north of the facility.

b. Collect one groundwater sample from each well.

c. Analyze each groundwater sample for organochlorine pesticides.

C. Well Installation and Cleanup

Well installations shall be cleaned up following the completion of the well. Drill cuttings shall be removed and the general area cleaned. A total of 38 wells (including eight pit wells) shall be installed. The exact location of wells in each zone shall be determined in the field.

D. Data Review

Results of sampling and analysis shall be tabulated and incorporated in the monthly R&D Status Reports and forwarded to the USAF OEHL for review as soon as they become available as specified in Item VI below.

E. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL as specified in Item VI below for Air Force review and comment. This report shall include a discussion of the regional hydrogeology, well logs of all project wells, data from water level surveys, aquifer test results and conclusions, water quality analysis results, restivity survey results and maps, available geohydrologic cross sections, groundwater surface and gradient vector maps, vertical and horizontal flow vectors and Laboratory quality assurance information. The report shall follow the USAF OEHL supplied format (mailed under separate cover).

2. Estimates shall be made of the magnitude, extent and direction of movement of contaminants discovered. Potential environmental consequences of discovered contamination shall be identified or estimated. Where survey data are insufficient to properly determine or estimate the magnitude, extent and direction of movement of discovered contaminants specific recommendations, fully justified, shall be made for additional efforts required to properly evaluate contamination migration.

3. Specific requirements, if any, for future groundwater and surface water monitoring must be identified.

F. Quality Assurance

The quality assurance specified in section H, para, (xxi) of the contract is applicable to this order.

G. Cost Estimates

Detailed cost estimates for all additional work recommended for those sites in need of proper determination or estimate of the magnitude, extent and direction of movement of discovered contaminants shall be provided, along with an estimate of the time required to accomplish the proposed effort. This information shall be provided in the final R&D Status report and shall be included in a separately bound appendix to the draft final report.

II. Site Location and Dates: MacDill AFB FL
USAF Hospital/SGPM
Dates to be established

III. Base Support: None

IV. Government Furnished Property: None

V. Government Points of Contact:

1. Maj Gary Fishburn
USAF OEHL/ECW
Brooks AFB TX 78235
(512) 526-3305
AV 240-3305

2. Col Jerry Dougherty
HQ TAC/SGPAE
Langley AFB VA 23665
(804) 764-2180
AV 432-2180

3. Capt Gary Pailthorp
USAF Regional Hospital MacDill/SGB
MacDill AFB, FL 33608
(813) 830-5213
AV 968-5213

VI. In addition to sequence numbers 1, 5 and 11 listed in Atch 1 to the contract, which are applicable to all orders, the reference numbers below are applicable to this order. Also shown are data applicable to this order.

Sequence Nr	Block 10	Block 11	Block 12	Block 13	Block 14
4*	ONE/R	84FEB29	84FEB29	84MAY31	*

*Contractor shall supply the USAF OEHL with 15 copies of the draft report and 50 copies plus the original, camera ready copy of the final report.

Required Sample Detection Limits

Chemical	Concentration Water	Concentration Soil
Lead	20 µg/l	0.2 µg/g
Total Organic Carbon (TOC)	1 mg/l	
Total Organic Halogen (TOX)	5 µg/l	
Polychlorinated Biphenyls (PCBs)	0.25 µg/l	
Phenols	1 µg/l	
Oils and Greases (IR Method)	0.1 mg/l	100 µg/g
Volatile Aromatics	*	
Volatile Halocarbons	*	
Aldrin	0.02 µg/l	
DDT Isomer	0.02 µg/l	
Dieldrin	0.02 µg/l	
Endrin	0.02 µg/l	
Heptachlor	0.02 µg/l	
Heptachlor Epoxide	0.02 µg/l	
Lindane	0.01 µg/l	
Methoxychlor	0.20 µg/l	

*Detection limits for volatile aromatics and volatile halocarbons shall be as specified for compounds listed in EPA Methods 601 and 602.

APPENDIX C

SAFETY PLAN

APPENDIX C
SAFETY PLAN

C-1.0 GENERAL

The safety plan presented herein gives guidelines for basic safety procedures and equipment utilized by WAR during the course of IRP Phase II surveys. Samples collected during Phase II surveys are typically environmental water and sediment samples as opposed to hazardous waste samples and normally do not require unusual levels of personnel protection. Detailed procedures and equipment required to minimize exposure to specific hazardous wastes or conditions requiring higher levels of protection are beyond the scope of this plan. References are provided from which waste-specific information on equipment and procedures can be obtained on a case-by-case basis.

C-2.0 INFORMATION REVIEW

Prior to initiating Phase II survey field work, the Phase I records search is reviewed in detail to identify hazardous wastes or conditions that may be encountered at each site. Available toxicological data on materials suspected of being present at the sites are reviewed to determine if the base level of personnel protection outlined in Section C-5.0 is adequate. Hazards such as the presence of highly toxic or incompatible chemicals, toxic gases, radioactive material, or explosives may require more extensive precautionary measures than the base level of protection. Safety hazards requiring special attention are addressed on an individual basis using appropriate assessment methods, and equipment and procedure recommendations given in the EPA Field Health and Safety Manual (EPA, 1980) and the EPA Safety Manual for Hazardous Waste Site Investigations (EPA, 1979). Hazardous conditions can be clarified or confirmed on preliminary site visits.

C-3.0 MEDICAL MONITORING PROGRAM

The person responsible for Phase II survey field work will determine whether a medical monitoring program is necessary, based on results of the information review. If hazard levels are judged high enough to

warrant this procedure, all field personnel will participate in a medical monitoring program. Guidelines for the program are given in Appendix I of the EPA Field Health and Safety Manual (EPA, 1980).

C-4.0 FIELD PERSONNEL INDOCTRINATION

All field personnel will be informed by the project field supervisor of required safety equipment and procedures prior to on-site work. Subjects covered will include personal safety gear, general and site-specific safety procedures, and incident notification procedures.

C-5.0 PERSONNEL PROTECTION GEAR

The following items will be provided on-site for all field personnel:

- o Tyvek® disposable coveralls,
- o Rubber boots,
- o Rubber gloves,
- o Hard hats, and
- o Eye protection (safety glasses or face shields).

Hearing protection (disposable ear plugs) will be provided for all work in the vicinity of the flight line or other noise hazards. Cartridge-type respirators will be available on-site for protection against inhalation of dust or vapors. If strong vapors are encountered, respirators will be utilized to facilitate evacuation of personnel and equipment from the site until the situation can be assessed or corrected.

Personal equipment described above will offer adequate protection for most situations encountered during the course of Phase II survey field work. When conditions are identified that require a higher level of personal protection, the EPA Safety Manual for Hazardous Waste Site Investigations will be referred to for guidance.

C-6.0 SAFETY PROCEDURES

Hard hats and eye protection will be worn when appropriate, as directed by the project field supervisor. Protective clothing (boots, gloves,

and coveralls) will be worn at all times while working on-site. Coveralls will be changed a minimum of once daily.

The project field supervisor will consult with the base environmental coordinator or other responsible contact regarding site-specific hazards prior to entering sites. Special procedures for entering and working at particular sites will be clarified and conveyed to all field personnel. Examples of areas requiring strict procedures are active runways or taxiways, fuel handling or storage areas, and secure areas.

Prior to any drilling or digging on the sites, USAF Form 103 must be routed to all applicable base organizations for a clearance review. Circulation of this form is required to avoid contact with underground or overhead utilities, conflict with base activities, or breaches of security.

Additional safety procedures will be implemented, if warranted by the information review or conditions encountered at the site. Site-specific safety procedures will be based on guidelines given in the EPA Field Health and Safety Manual and the EPA Safety Manual for Hazardous Waste Site Investigations.

C-7.0 INCIDENT/ACCIDENT NOTIFICATION PROCEDURES

As a minimum, the following emergency phone numbers should be available on-site:

1. Ambulance or medical assistance,
2. Base fire department (or other if off-site), and
3. USAF contact for project.

After contacting appropriate emergency services, or in nonemergency incidents, the USAF project contact should be notified of the incident or accident so that it can be dealt with according to base policies and procedures.

APPENDIX D

WELL LOGS

Table D-1. Well Data Summary—Phase IIb Installation Restoration Program Wells, MacDill AFB and Avon Park AFR

Well No.	Depth Ft.	Screen Ft.	TOC* Ft., MSL	DTW, Ft.† (Oct. 1983)	WL** Ft., MSL
MD3-1	10	5	7.05	5.60	1.45
MD3-2	10	5	6.19	5.29	0.90
MD3-3	10	5	6.49	4.58	1.91
MD58-1	15	10	6.45	5.21	1.24
MD58-2	15	10	6.45	5.44	1.01
MD58-3	15	10	8.10	6.42	1.68
MD58-4	15	10	8.73	7.25	1.48
MD9-1	10	5	5.58	2.42	3.16
MD9-2	15	10	5.38	3.38	2.00
MD9-3	15	10	5.40	2.90	2.50
MDA-1	10	10	10.40	7.54	2.86
MDA-2	10	10	10.80	7.75	3.05
MDA-3	10	10	10.35	7.46	2.89
MDA-4	10	10	9.72	8.35	1.37
MD17-1	20	10	12.37	6.25	6.12
MD17-2	19	10	11.71	4.65	7.06
MD23-1	20	10	14.18	9.06	5.12
MD23-2	17	15	11.40	9.46	1.94
MD23-3	15	10	12.93	6.50	6.43
MD23-4	15	10	11.94	4.58	7.36
MD23-5	15	10	12.62	5.52	7.10
MD23-6	15	10	12.88	5.58	7.30
AP6-1	15	10	62.51	7.38	55.13
AP6-2	15	10	57.61	4.35	53.26
AP6-3	15	10	59.76	4.17	55.59
AP7-1	15	10	63.99	3.00	60.99
AP7-2	15	10	63.65	4.25	59.40
AP7-3	15	10	64.45	4.69	59.76
AP11-1	10	5	61.74	4.85	56.89
AP11-2	10	5	62.55	5.40	57.15

*Elevation of the top of the casing in feet above msl.
†Distance, in feet, from the top of the casing to the water surface.
**Elevation of the water surface in feet, msl datum.

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SHEET 1 OF 1

Boring No. MD 3-1

Hole Size 3 IN x 10 FT Slot 0.010"

Screen Size 2 IN x 5 FT Mat'l SCH 40 PVC

Casing Size 2 IN x 6 FT Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 14 SE 83 Finish 15 SE 83

Contractor WAR/PTL

Driller P. SCHUMATE

Location Coordinates 1,273,729 N
341,128 E

Filter Materials 20/30 SAND

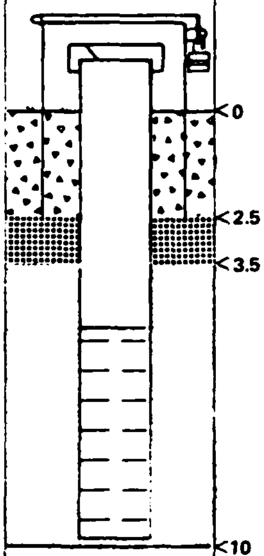
Grout Type SAND-CEMENT

Protective Casing 6 IN x 5 FT BIP

Static Water Level

Top of Well Elevation 7.05 FT MSL

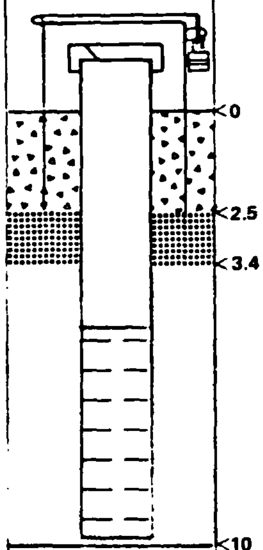
Drill Type 3 IN HSA. CME-45



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, W. ROUNDED, TR SLT & CL, TR OM, MOIST DK. GRAY (10 YR 4/1).	SP	N/A
		4-6 FT	4-5: AS ABOVE. 4.5-6: SAND, VF-F, QTZ, SUB-ANG., TR SLT & CL, SATURATED, PALE YELLOW (2.5 Y 7/4).	SP	8
		9-11	10: AS ABOVE. 10-11: CLAY, SILTY, MOIST, V. STIFF, BLUE-GREEN & WHITE.	CL	11

Water and Air Research, Inc. SHEET 1 OF 1

Boring No. MD 3-2	Location Coordinates 1,273,320 N
Hole Size 8 IN x 10 FT Slot 0.010"	341,084 E
Screen Size 2 IN x 5 FT Mat'l SCH 40 PVC	Filter Materials NATIVE SAND
Casing Size 2 IN x 5.4 FT Mat'l SCH 40 PVC	Grout Type 2:1 SAND CEMENT
Geologist W. D. ADAMS	Protective Casing 6" x 5' B.I.P.
Date Start 15 SE 83 Finish 15 SE 83	Static Water Level
Contractor WAR/PTL	Top of Well Elevation 6.19 FT MSL
Driller P. SCHUMATE	Drill Type CME-55; 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0-1.5	SAND, VF-F, QTZ, WELL ROUND TO SUB-ROUND, TR SLT & CLAY, MOIST, V. DK GRAY, (5 YR 3/1).	SP	N/A
		4½-6½	SAND, VF-F, QTZ, SUB-ANG, ~15% SLT & CLAY IN UPPER PART, TR SLT & CLAY LOWER FT, DK. RED. BRN (5 YR 3/2) THEN WHITE (5YR 8/1). SATURATED.	SP	7
		9-11	CLAY, SANDY (~5-15% VF-F SD & SLT), V. STIFF, SATURATED, BL. GREEN.	CL	11

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SHEET 1 OF 1

Boring No. MD 3-3

Location Coordinates 1,273,545 N

341,883 E

Hole Size 8 IN x 10 FT Slot 0.010

Screen Size 2 IN x 5 FT Mat'l SCH 40 PVC

Filter Materials 20/30 SAND

Casing Size 2 IN x 5.4 FT Mat'l SCH 40 PVC

Grout Type 2:1 SAND-CEMENT

Geologist W. D. ADAMS

Protective Casing 6 IN x 5 FT IRON

Date Start 15 SE 83 Finish 15 SE 83

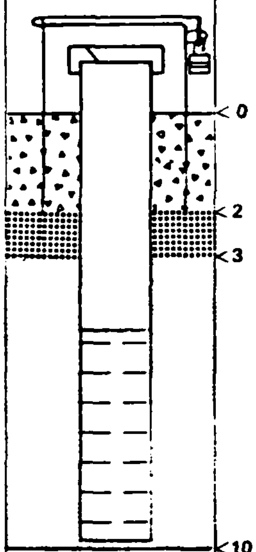
Static Water Level

Contractor WAR/PTL

Top of Well Elevation 6.49

Driller P. SCHUMATE

Drill Type 8" HSA; CME-55



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, WELL ROUND, TR SLT & CL, TR OM, MOIST, V. DK GRAY (2.5 YR 3/0).	SP	N/A
		4-6	SAND, VF-F, QTZ & TR HVY MIN, SUB-ANG, TR SLT & CL, SATURATED, WHITE (2.5 Y 8/2)	SP	7
		9-10	SAND, AS ABOVE.	SP	8
		10-11	CLAY, SANDY, ~30% VF-F SD & SLT, SOFT, MOIST, V. LT. BLUE.	CL-SC	

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SHEET 1 OF 1

Boring No. MD 58-1

Hole Size 8" x 15 FT Slot 0.010"

Screen Size 2" x 10 FT Mat'l SCH 40 PVC

Casing Size 2" x 8 FT Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 21 SE 83 Finish 21 SE 83

Contractor WAR/PTL

Driller P. SCHUMATE

Location Coordinates 1,273,690 N

336,652 E

Filter Materials 20-30 SAND

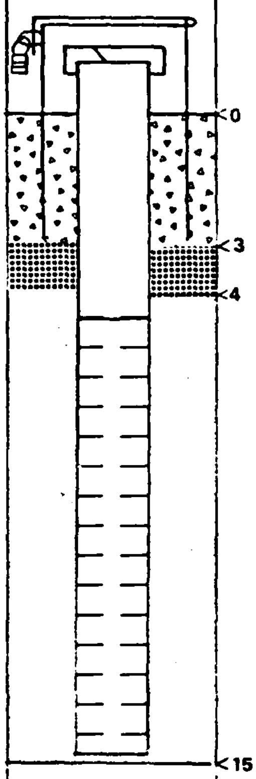
Grout Type 2:1 SAND CEMENT

Protective Casing 6" x 5' B.I.P.

Static Water Level

Top of Well Elevation 6.45 FT MSL

Drill Type CME-55; 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, TR OM, DRY, LT GRAY.	SP	N/A
		4-6	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, SAT. DK BRN (10YR 3/3) OVER WHITE (2.5Y 8/2).	SP	10
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, SAT., WHITE (10YR 8/1).	SP	19
		14-16	SAND, VF-F, QTZ, TR HVY MIN, ~5% SLT & CL, SAT., WHITE (10YR 8/2) & V. PALE BRN (10YR 8/3).	SP	26

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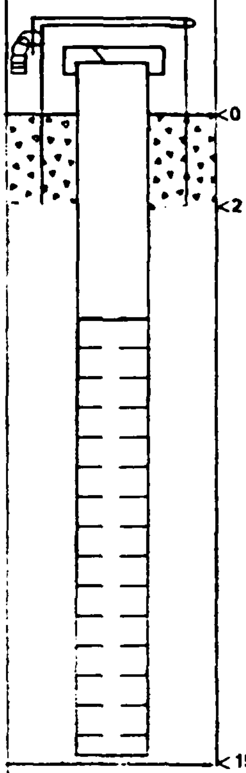
SHEET 1 OF 1

Boring No.	MD 58-2	Location Coordinates	1,273,702 N
Hole Size	8" x 15 FT Slot 0.010"		336,162 E
Screen Size	2" x 10 FT Mat'l SCH 40 PVC	Filter Materials	20-30 SAND
Casing Size	2" x 8 FT Mat'l SCH 40 PVC	Grout Type	SAND-CEMENT (2:1)
Geologist	W. D. ADAMS	Protective Casing	6" x 5' B.I.P.
Date Start	21 SE 83 Finish 21 SE 83	Static Water Level	
Contractor	WAR/PTL	Top of Well Elevation	6.45 FT MSL.
Driller	P. SCHUMATE	Drill Type	CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, DRY, LT. GRAY.	SP	N/A.
		4-6	SAND, VF-F, QTZ, ANGULAR, TR SLT & CL, SAT., LT GRAY (5Y 7/1).	SP	17
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, SAT, LT. GRAY (2.5Y 7/2).	SP	11
		14-16	SAND, AS ABOVE.	SP	16

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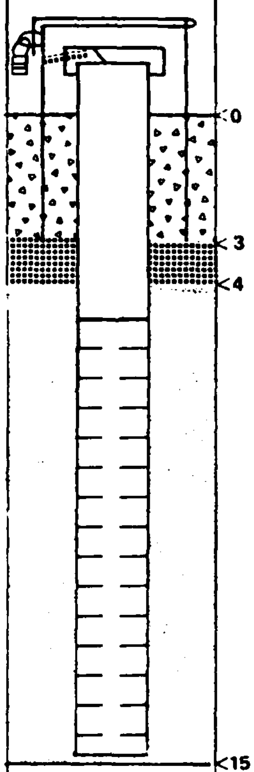
SHEET 1 OF 1

Boring No.	MD 58-3	Location Coordinates	1,273,700 N
Hole Size	8" x 15 FT Slot 0.010"		335,534 E
Screen Size	2" x 10 FT Mat'l SCH 40 PVC	Filter Materials	20-30 SAND
Casing Size	2" x 8 FT Mat'l SCH 40 PVC	Grout Type	SAND-CEMENT (2:1)
Geologist	W. D. ADAMS	Protective Casing	6" x 5' IRON
Date Start	22 SE 83 Finish 22 SE 83	Static Water Level	
Contractor	WAR / LETCO	Top of Well Elevation	8.10 FT MSL
Driller	P. SCHUMATE	Drill Type	CME-55; 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, SUB-ROUND, TR SLT & CL, TR O.M. V. DK. GRAY (5Y 3/1).	SP	N.A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, SAT, WHITE (10 YR 8/2).	SP	17
		9-11	SAND, CLAYEY SD, VF-F, QTZ, TR HVY MIN, ANG, ~10% SLT & CL, SAT., LT GRAY (10 YR 7/2)	SP-SC	19
		14-16	14-15: SAND, AS ABOVE. 15-16: CLAY, TR SLT & VF SD, STIFF, MOIST, GRAY-BLUE.	SP-SC CH	11

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SHEET 1 OF 1

Boring No. MD 58-4

Hole Size 8" x 15FT Slot 0.010"

Screen Size 2" x 10FT Mat'l SCH 40 PVC

Casing Size 2" x 8 FT Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 21 SE 83 Finish 21 SE 83

Contractor WAR/PTL

Driller P. SCHUMATE.

Location Coordinates 1,273,714 N
333,516 E

Filter Materials 20-30 SAND

Grout Type SAND - CEMENT

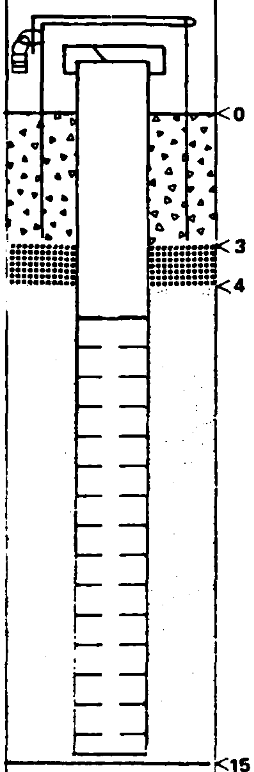
Protective Casing 6" x 5' IRON

Static Water Level

Top of Well Elevation 8.73FT MSL

Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, SUB-ROUND, TR SLT & CL, TR OM, MOIST, V. DK. GRAY (10YR 3/1).	SP	N.A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANG., TR SLT & CL, MOIST, GRAY (10YR 6/1) OVER BROWN (10 YR 4/3).	SP	26
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, SAT., LT GRAY (10YR 7/1).	SP	9
		14-16	SAND, VF-F, QTZ, TR HVY MIN, ANG, ~5% SLT & CL, SAT., LT GRAY (10 YR 7/1).	SP	30



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SHEET 1 OF 1

Boring No. MD 9-1

Hole Size 8IN X 10FT Slot 0.010"

Screen Size 2IN x 5FT Mat'l SCH 40PVC

Casing Size 2IN x 6.8FT Mat'l SCH 40PVC

Geologist W. D. ADAMS

Date Start 16 SE 83 Finish 16 SE 83

Contractor WAR/PTL

Driller PHIL. SCHUMATE

Location Coordinates 1,272,058 N

337,342 E

Filter Materials 20-30 SAND

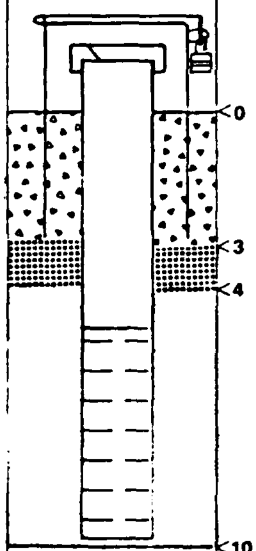
Grout Type 2:1 SAND CEMENT

Protective Casing 6" x 5' B.I.P.

Static Water Level

Top of Well Elevation 5.58 FT MSL

Drill Type CME-55; 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SILT, SANDY. ~30% VF-F SD, QTZ, ~20% CL, SAT., BLACK. H_2S ODOR.		N/A
		4-6	SAND, VF-F, QTZ, SUB-ROUND, TR SLT & CL, MOIST, WHITE (10YR 8/2). H_2S ODOR	SP	21
		9-11	SAND, CLAYEY, VF-F, QTZ, SUB-ROUND, ~30% SLT & CL, SATURATED, WHITE (10YR 8/2)	SC	11
			10:11 CLAY, SANDY, ~10% VF-F SD, STIFF, MOIST, BLUE.	CL	

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SHEET 1 OF 1

Boring No. MD 9-2

Location Coordinates 1,272,293 N
337,085 E

Hole Size 8 IN x 15 FT Slot 0.010

Screen Size 2 IN x 10 FT Mat'l SCH 40 PVC

Filter Materials 20-30 SAND

Casing Size 2 IN x 6.5 FT Mat'l SCH 40 PVC

Grout Type SAND - CEMENT (2:1)

Geologist W. D. ADAMS

Protective Casing 6" x 5' IRON

Date Start 16 SE 83 Finish 16 SE 83

Static Water Level

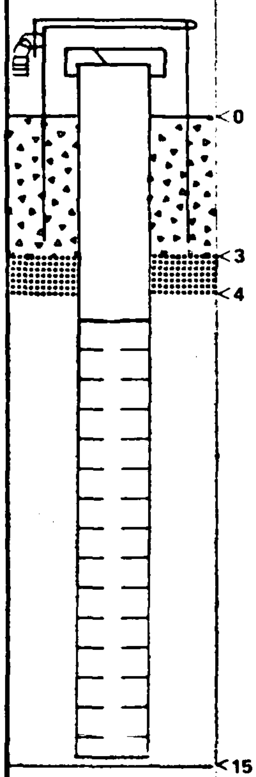
Contractor WAR/PTL

Top of Well Elevation 5.38 FT MSL

Driller P. SCHUMATE

Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0-6	SAND, VF-F, QTZ, SUB-ANG, TR SLT & CL, TR OM, SAT., GRAY (5Y 6/1). H_2S ODOR.	SP	9
		9-11	SAND, VF-F, QTZ, SUB-ANG, TR SLT & CL, SAT, LT GRAY (10YR 7/2)	SP	7
		14-16	CLAY, ~30% VF-F SD, STIFF, SAT., BLUE.	CL	7



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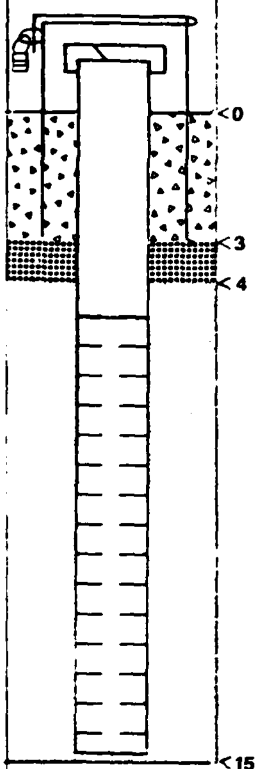
SHEET 1 OF 1

Boring No.	MD 9-3	Location Coordinates	1,272,936 N 337,070 E
Hole Size	8 IN x 15 FT Slot 0.010	Filter Materials	20-30 SAND
Screen Size	2 IN x 10 FT Mat'l SCH 40 PVC	Grout Type	2:1 SAND-CEMENT
Casing Size	2 IN x 6.4 FT Mat'l SCH 40 PVC	Protective Casing	6" x 5' IRON
Geologist	W. D. ADAMS	Static Water Level	
Date Start	16 SE 83 Finish 16 SE 83	Top of Well Elevation	5.40 FT MSL
Contractor	WAR/PTL	Drill Type	CME-55; 8" HSA
Driller	P. SCHUMATE		



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, SUB-ROUND ~15% SLT & CL, TR OM, MOIST, BLACK, H_2S ODOR	SP-SC	N/A
		4-6	SAND, VF-F, QTZ, SUB-ROUND, TR SLT & CL, SAT, LT GRAY (2.5Y 7/2)	SP	6
		9-11	SAND, CLAYEY. [illegible], VF-F, QTZ TR HVY MIN, WELL-ROUND, ~20% SLT & CL, SAT, WHITE (2.5Y N8/)	SC	7
		14-16	CLAY, SANDY. CL, c̄ ~20% VF-F, QTZ, WELL-ROUND, SD, SLT, STIFF, SAT., BL. GRAY c̄ STREAKS SAND, VF-F, QTZ, TR SLT & CL., WHITE.	CL-SC	11

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SHEET 1 OF 1

Boring No. MD A-1

Location Coordinates 1,280,767 N
341,554 E

Hole Size 8" x 10FT Slot 0.010"

Screen Size 2" x10FT Mat'l SCH 40PVC

Filter Materials 20-30 SAND

Casing Size 2" x 2.5FT Mat'l SCH 40PVC

Grout Type BEN. PEL.

Geologist W. D. ADAMS

Protective Casing N.A.

Date Start 22 SE 83 Finish 22 SE 83

Static Water Level 7.67 FT TOC

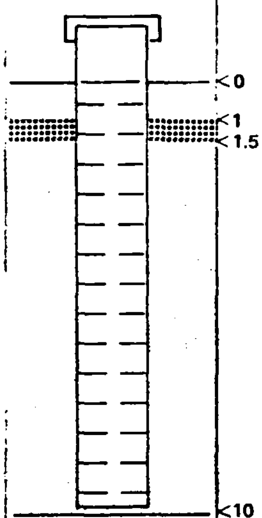
Contractor WAR/PTL

Top of Well Elevation 10.40 FMSL

Driller P. SCHUMATE

Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, TR O.M., MOIST, LT. GRAY (10 YR 7/1).	SP	N.A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, SAT, GRAY (5Y 5/1).	SP	7
		9-11	SAND, AS ABOVE.	SP	12



Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. MD A-2

Location Coordinates 1,230,808 N
341,596 E

Hole Size 8" x 10 FT Slot 0.010"

Screen Size 2" x 10 FT Mat'l SCH 40 PVC

Filter Materials 20-30 SAND

Casing Size 2" x 2.5 FT Mat'l SCH 40 PVC

Grout Type BEN. PEL.

Geologist W. D. ADAMS

Protective Casing N. A.

Date Start 22 SE 83 Finish 22 SE 83

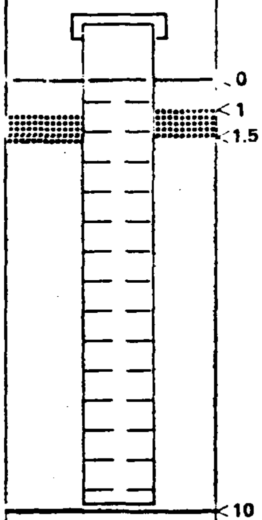
Static Water Level 3.04 FT TOC

Contractor WAR/PTL

Top of Well Elevation 10.80 FT MSL

Driller P. SCHUMATE

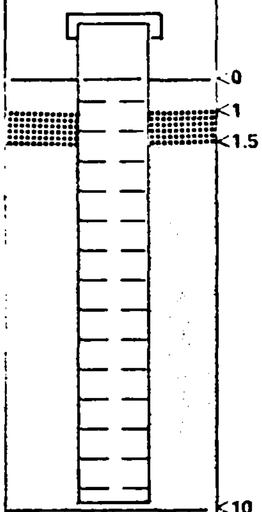
Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, TR OM, MOIST, LT GRAY (10 YR 7/1).	SP	N.A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, SAT., GRAY (5 Y 5/1).	SP	3
		9-11	SAND, AS ABOVE, LT. GRAY (10 YR 7/2).	SP	14

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No.	MD A-3	Location Coordinates	1,280,839 N 341,628 E
Hole Size	8" x 10FT Slot 0.010"		
Screen Size	2" x 10FT Mat'l SCH 40PVC	Filter Materials	20-30 SAND
Casing Size	2" x 2.5FT Mat'l SCH 40PVC	Grout Type	BEN. PEL.
Geologist	W. D. ADAMS	Protective Casing	N. A.
Date Start	22 SE 83 Finish 22 SE 83	Static Water Level	7.67 FT ~~AGSL~~ TOC
Contractor	WAR/PTL	Top of Well Elevation	10.35 FT MSL
Driller	P. SCHUMATE	Drill Type	CME-55; 8" HSA

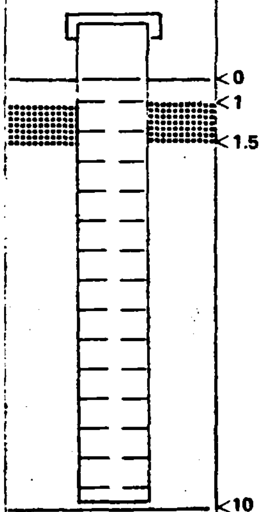
Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN., ANG, TR SLT & CL, TR O.M., MOIST, LT GRAY (10 YR 7/1).	SP	N.A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANG, ~~TR~~ SLT & CL, SAT. DK. GRAY (10 YR 4/1).	SP	1
		9-11	SAND, AS ABOVE, V. PALE BRN (10 YR 7/3).	SP	3

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. MD A-4	Location Coordinates 1,280,876 N
Hole Size 8"x10FT Slot 0.010"	341,663 E
Screen Size 2"x10FT Mat'l SCH 40PVC	Filter Materials 20-30 SAND
Casing Size 2"x2.5FT Mat'l SCH 40PVC	Grout Type BEN. PEL.
Geologist W. D. ADAMS	Protective Casing N. A.
Date Start 22 SE 83 Finish 22 SE 83	Static Water Level 8.21 FT TOC
Contractor WAR/PTL	Top of Well Elevation 9.72 FT MSL
Driller P. SCHUMATE	Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, MOIST, LT GRAY (10YR 7/1).	SP	N.A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, WET, FUEL ODOR 5-6 FT, V. PALE BROWN (10YR 7/3).	SP	6
		9-11	SAND, AS ABOVE, FUEL ODOR ~10 FT.	SP	4



Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. MD 17-L

Location Coordinates 1,232,468 N
332,464 E

Hole Size 8 IN X 20 FT Slot 0.010

Screen Size 2 IN X 10 FT Mat'l SCH 40 PVC

Filter Materials 20-30 SAND

Casing Size 2 IN X 10.4 FT Mat'l SCH 40 PVC

Grout Type 2:1 SAND CEMENT

Geologist W. D. ADAMS

Protective Casing 6" x 5' IRON

Date Start 17 SEP 83 Finish 17 SEP 83

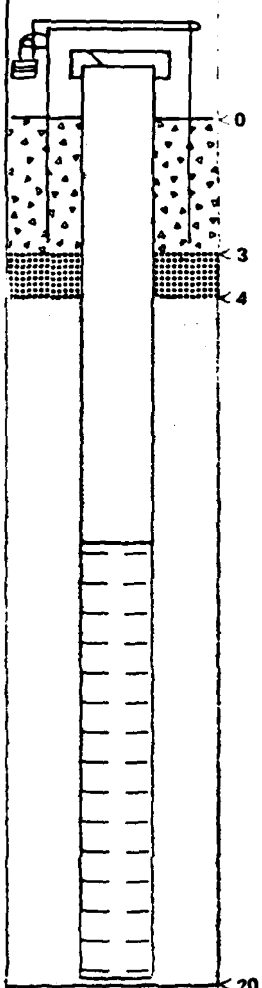
Static Water Level

Contractor WAR/PTL

Top of Well Elevation 12.37 FT MSL

Driller D. ARTHUR

Drill Type CME-55; 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, SUB-ROUND, TR SLT & CL, TR OM, DRY, V. DK GRAY (7.5YR N3/)	SP	N/A.
		4-6	SAND, AS ABOVE EXCEPT NO OM, YELLOW (10YR 7/5) SATURATED.	SP	7
		9-11	SAND, AS ABOVE, WHITE (10 YR 8/1).	SP.	8
		14-16	SAND, AS ABOVE.	SP	19
		19-21	SAND, VF-F, QTZ, TR HVY MIN, ANGULAR, TR SLT & CL, SATURATED, WHITE.	SP.	83

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. MD17-2

Hole Size 8 IN x 19 FT Slot 0.010"

Screen Size 2 IN x 10 FT Mat'l SCH 40 PVC

Casing Size 2 IN x 10 FT Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 19 SE 83 Finish 19 SE 83

Contractor WAR/PTL

Driller D. ARTHUR

Location Coordinates 1,282,610 N

332,461 E

Filter Materials 20-30 SAND

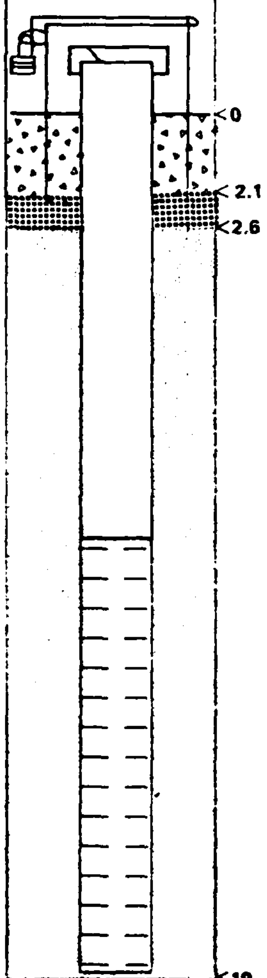
Grout Type 2:1 SAND CEMENT

Protective Casing 6" x 5' IRON

Static Water Level

Top of Well Elevation 11.71

Drill Type CME-55; 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, WELL-ROUNDED, TR SLT & CL, TR OM, MOIST, V. DK. GRAY (5 YR 3/1).	SP	N/A
		4-6	SAND, VF-F, QTZ, WELL-ROUNDED, TR SLT & CL, SAT., WHITE IN UPPER PART, YELLOW (10YR 7/6) IN LOWER.	SP	15
		9-11	SAND, VF-F, QTZ, ANGULAR TR SLT & CL, SAT, WHITE.	SP	13
		14-16	SAND, AS ABOVE.	SP.	51
		19-21	SAND, AS ABOVE.	SP	49

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. MD 23-1

Location Coordinates 1,278,930 N
333,885 E

Hole Size 8 IN x 20 FT Slot 0.010"

Screen Size 2 IN x 10 FT Mat'l SCH 40 PVC

Filter Materials 20-30 SAND

Casing Size 2 IN x 12.5 FT Mat'l SCH 40 PVC

Grout Type SAND - CEMENT (2:1)

Geologist W. D. ADAMS

Protective Casing 6" x 5' B.I.P.

Date Start 19 SE 83 Finish 19 SE 83

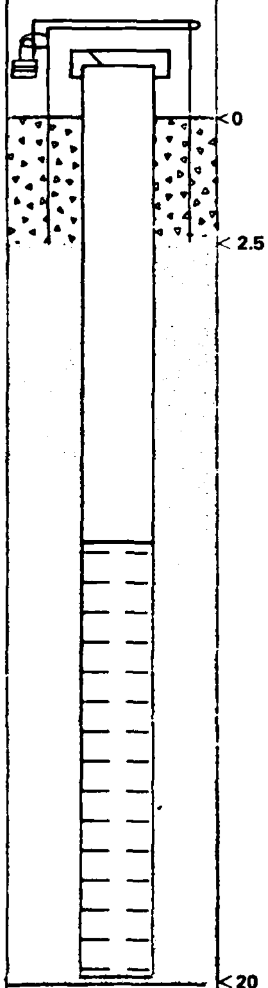
Static Water Level

Contractor WAR/PTL

Top of Well Elevation 14.18 FT MSL

Driller P. SCHUMATE

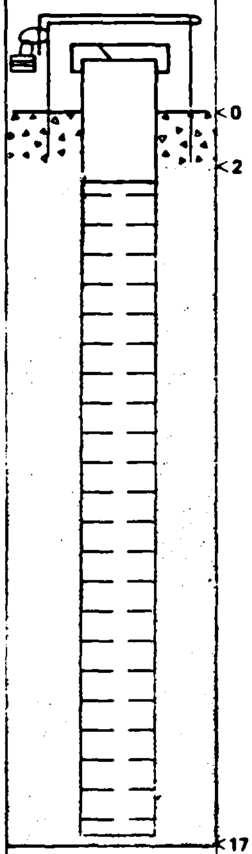
Drill Type CME - 55; 8" HSA.



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, F-VF, QTZ, TR HVY MIN, WELL-ROUNDED, TR SLT & CL., MOIST, WHITE (10YR 8/1)	SP	N/A.
		4-6	SAND, F-VF, QTZ, TR HVY MIN LIMONITE STAIN, TR MED SD, TR CL & SLT, SATURATED (10YR 6/8).	SP	
		9-11	SAND, AS ABOVE, GRAY (10YR 6/1).	SP	
		14-16	SAND, CLAYEY, VF-MED SAND, QTZ, ~10% PHOSPHATE, ~10% SLT & CL, SATURATED, YELLOW (2.5Y 7/6) & GRAY (7.5YR 6/0)	SP-SC	
		19-21	SAND, CLAYEY, VF-MED SAND, QTZ, ~20% PHOSPHATE (DECREASES DOWNWARD) ~25% SLT & CL, SATURATED, GRAY (5Y 6/1).	SC	

Water and Air Research, Inc. SHEET 1 OF 1

Boring No. MD 23-2 | Location Coordinates 1,273,693 N
Hole Size 8 IN × 17 FT Slot 0.010" | 333,801 E
Screen Size 2 IN × 15 FT Mat'l SCH 40 PVC | Filter Materials 20-30 SAND
Casing Size 2 IN × 3.7 FT Mat'l SCH 40 PVC | Grout Type 2:1 SAND - CEMENT
Geologist W. D. ADAMS | Protective Casing 6" × 5' IRON
Date Start 19 SE 83 Finish 20 SE 83 | Static Water Level
Contractor WAR/PTL | Top of Well Elevation 11.40 FT MSL
Driller P. SCHUMATE | Drill Type CME-55; 8" HSA

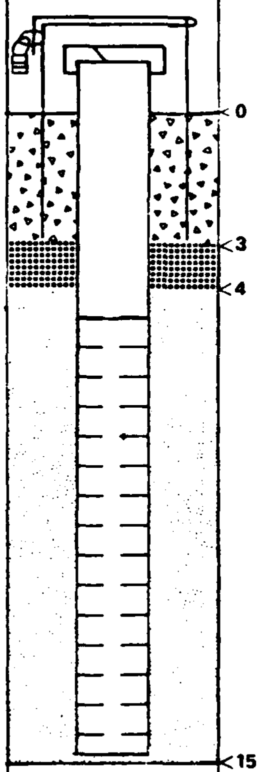


Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, WELL-ROUNDED, TR SLT & CL, MOIST, WHITE.	SP	N/A
		4-6	SAND, VF-F, QTZ, TR HVY MIN, ANGULAR, MOIST, TR SLT & CL, WHITE (10YR 8/1) AND PALE YELLOW (2.5Y 8/4).	SP	17
		9-11	SAND, VF-F, QTZ, ANGULAR, SATURATED, ~5% SLT & CL, LT. GRAY (5Y 7/2). "SOLVENT" ODOR.	SP	12
		14-16	SAND, VF-F, QTZ, SUB-ROUND. SATURATED, ~10% SLT & CL, V. DK. GRAY (2.5Y N3/).	SP	6

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No.	MD 23-3	Location Coordinates	1,278,775 N 333,659 E
Hole Size	8" x 15' Slot 0.010"		
Screen Size	2" x 10' Mat'l SCH 40 PVC	Filter Materials	20-30 SAND
Casing Size	2" x 7' Mat'l SCH 40 PVC	Grout Type	SAND-CEMENT (2:1)
Geologist	W. D. ADAMS	Protective Casing	6" x 5' (B.I.P.)
Date Start	20 SE 83 Finish 20 SE 83	Static Water Level	
Contractor	WAR/PTL	Top of Well Elevation	12.93 FT MSL
Driller	D. ARTHUR	Drill Type	CME-55, 8" HSA

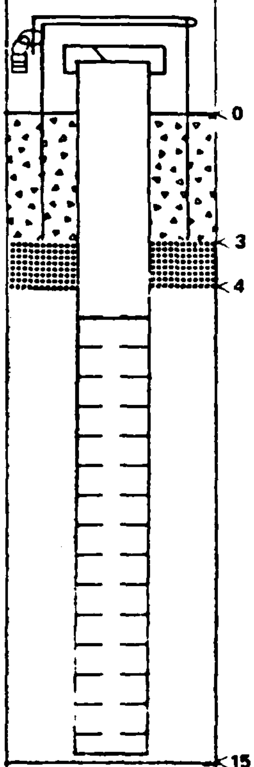


Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, TR OM, MOIST, WHITE.	SP	N/A
		4-6	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, WET, "SOLVENT" ODOR, V. PALE BRN (10 YR 8/3).	SP	8
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ANGULAR, ~25% SLT & CL, SATURATED, LT. GRAY (5Y 7/1).	SC-SP	13
		14-16	SAND, VF-F, QTZ, ~5% HVY MIN, SUB-ROUND, ~20% SHELL FRAGS, ~25% SLT & CL, SATURATED, GRAY (5Y 5/1).	SC-SP	12

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. MD 23-4 | Location Coordinates 1,277,784 N
Hole Size 8" x 15 FT Slot 0.010" | 335,077 E
Screen Size 2" x 10 FT Mat'l SCH 40 PVC | Filter Materials 20-30 SAND
Casing Size 2" x 8 FT Mat'l SCH 40 PVC | Grout Type 2:1 SAND - CEMENT
Geologist W. D. ADAMS | Protective Casing 6" x 5' IRON.
Date Start 20 SE 83 Finish 20 SE 83 | Static Water Level
Contractor WAR / PTL | Top of Well Elevation 11.94 FT MSL
Driller D. ARTHUR | Drill Type CME-55, 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, ~5% SLT & CL, ~5% HVY MIN, TR GRAVEL, SATURATED, GRAY (10YR 5/1).	SP	N/A.
		4-6	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, SATURATED, GRAY (5Y 6/1). FUEL ODOR.	SP	5
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ~10% SLT & CL, SATURATED, GRAY (10YR 6/1).	SP	10
		~13	SAND, c̄ SHELL. VF-F, QTZ SD c̄ TR HVY MIN & CLAY, c̄ ABNDNT SHELL INCL CHIONE CANCELLATA.	SP	N/A.
		14-16	14:15.5: SAND, VF-F, QTZ, ~5% HVY MIN, ~5% SLT & CL, SAT., GRAY (10YR 6/1). 15.5-16: CLAY, TR SLT & VF SD, STIFF, MOIST, BLUE-GREEN.	SP CH	21

Water and Air Research, Inc. SHEET 1 OF 1

Boring No. MD 23-5

Location Coordinates 1,277,880 N
335,069 E

Hole Size 8" x 15FT Slot 0.010"

Screen Size 2" x 10FT Mat'l SCH 40PVC

Filter Materials 20-30 SAND

Casing Size 2" x 8FT Mat'l SCH 40PVC

Grout Type 2:1 SAND - CEMENT.

Geologist W. D. ADAMS

Protective Casing 6" x 5' B.I.P.

Date Start 20SE83 Finish 20SE83

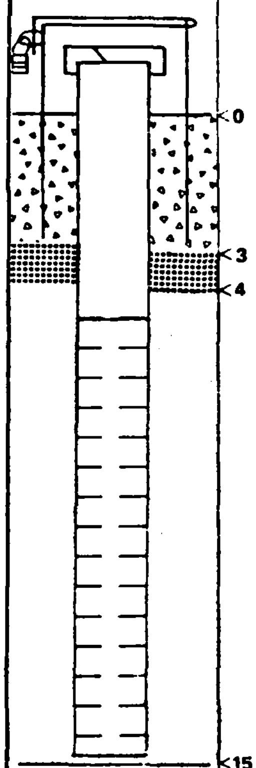
Static Water Level

Contractor WAR/PTL

Top of Well Elevation 12.62 FT MSL

Driller D. ARTHUR

Drill Type CME-55; 8" HSA

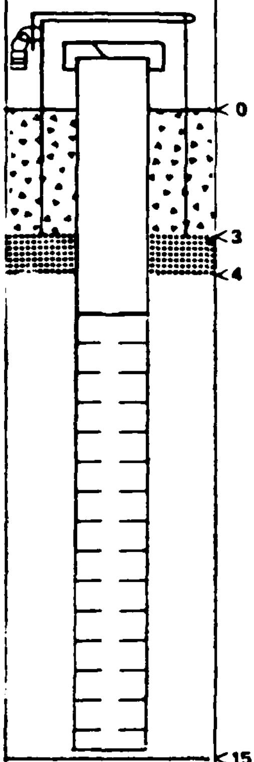
Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, ~5% HVY MIN, ~5% SLT & CL, TR GRAVEL, WET, GRAY (10YR5/1)	SP	N/A
		4-6	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, SATURATED, FUEL ODOR, GRAY (5Y6/1).	SP	6
		9-11	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, SATURATED, LT. GRAY (10 YR 7/1).	SP	17
		14-16	SAND, VF-F, QTZ, ~5% PHOSPHATE, TR SLT & CL, TR PHOS. PEBBLES, SATURATED, GRAY (10 YR 6/1).	SP	23

Water and Air Research, Inc. SHEET 1 OF 1

Boring No. MD 23-6
Location Coordinates 1,277,846 N
334,993 E

Hole Size 8" x 15 FT Slot 0.010"
Screen Size 2" x 10 FT Mat'l SCH 40 PVC
Filter Materials 20-30 SAND
Casing Size 2" x 8 FT Mat'l SCH 40 PVC
Grout Type 2:1 SAND-CEMENT
Geologist W. D. ADAMS
Protective Casing 6" x 5' IRON
Date Start 20 SE 83 Finish 21 SE 83
Static Water Level
Contractor WAR/PTL
Top of Well Elevation 12.83 FT MSL
Driller D. ARTHUR
Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, ~5% GRAVEL, ~5% SLT & CL, WET, GRAY (10YR 5/1).	SP	N/A
		4-6	SAND, SHELLY. VF-F, QTZ SD c TR HVY MIN, ~20% SHELL, ~10% SLT & CL, SATURATED, FUEL ODOR, YELLOW (2.5Y 7/6)	SP-SC	6
		9-11	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, SATURATED, GRAY (5Y 6/1).	SP	9
		14-16	SAND, SHELLY. VF-F QT SD c ~10% PHOSPHATIC SD & ~20% SHELL, ~10% SLT & CL, SATURATED, LT GRAY (10YR 7/1).	SP-SC	9



Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 6-1

Hole Size 8" x 15' Slot 0.010"

Screen Size 2" x 10' Mat'l SCH 40 PVC

Casing Size 2" x 7.0' Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 27 SE 83 Finish 27 SE 83

Contractor WAR/PTL

Driller P. SCHOMATE.

Location Coordinates 1,201,875.88 N
707,109.46 E

Filter Materials NATIVE SAND

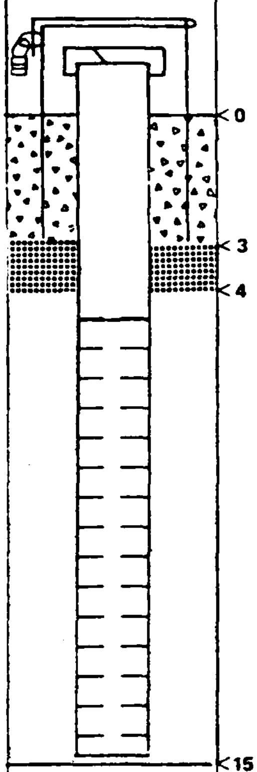
Grout Type 2:1 SAND CEMENT

Protective Casing 6" x 5' B.I.P.

Static Water Level

Top of Well Elevation 62.51 FT MSL

Drill Type CME-55; 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, DRY, WHITE.	SP	N.A.
		4-6	SAND, AS ABOVE, WET.	SP	16
		9-11	SAND, AS ABOVE EXCEPT ~ 20% SLT & CL, SAT, LT. BRN. GRAY (10YR 6/2).	SP-SC	17
		14-16	SAND, AS ABOVE, LT. GRAY (10YR 7/2).	SP-SC	10

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 6-2

Hole Size 8" x 15 FT Slot 0.010"

Screen Size 2" x 10 FT Mat'l SCH 40 PVC

Casing Size 2" x 7 FT Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 27 SE 83 Finish 27 SE 83

Contractor WAR/PTL

Driller P. SCHUMATE

Location Coordinates 1,201,698.01 N

707,833.68 E

Filter Materials NATIVE SAND

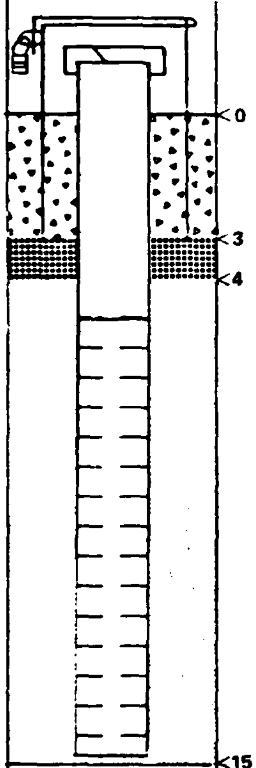
Grout Type 2:1 SAND CEMENT

Protective Casing 6" x 5' BIP

Static Water Level

Top of Well Elevation 57.61 FT MSL

Drill Type CME - 55, 8" HSA



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, TR O.M., DRY, LT. GRAY (10YR 7/2).	SP	N.A.
		4-6	4-5: SAND, AS ABOVE, NO O.M., MOIST, WHITE.	SP	10
			5-6: SAND, CLAYEY. SD, VF-F, QTZ, TR HVY MIN, ANG., ~30% SLT & CL, SAT, DK GRAY (5Y 4/1).	SC	
		9-11	SAND, CLAYEY. AS ABOVE.	SC	11
		14-16	SAND, VF-F, QTZ, TR HVY MIN, ANG, ~10% SLT & CL, SAT, GRAY (10YR 6/1).	SP	6

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 6-3

Hole Size 8" x 15 FT Slot 0.010"

Screen Size 2" x 10 FT Mat'l SCH 40 PVC

Casing Size 2" x 7.5 FT Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 27 SE 83 Finish 27 SE 83

Contractor WAR/PTL

Driller P. SCHUMATE

Location Coordinates 1,201,469.33 N
707,267.60 E

Filter Materials NATIVE SAND

Grout Type 2:1 SAND CEMENT

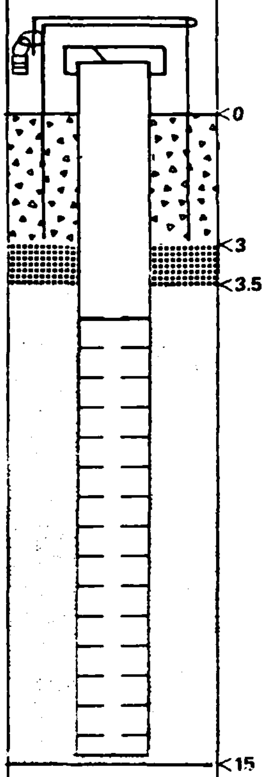
Protective Casing 6" x 5' BIP

Static Water Level

Top of Well Elevation 59.76 FT MSL

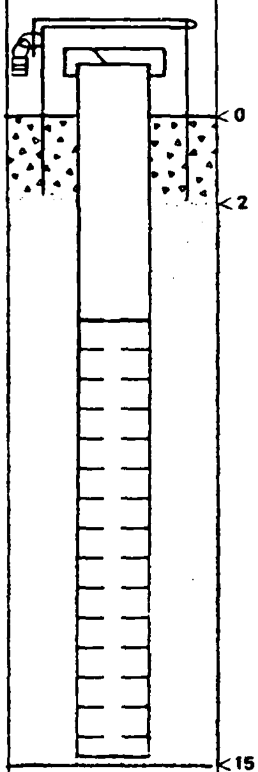
Drill Type CME-55; 8" HSA.

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, TR SLT & CL, TR O.M, DRY, LT GRAY (10YR 7/1).	SP	N.A.
		4-6	SAND, AS ABOVE EXCEPT SAT., NO O.M., GRAY (2.5Y 5/1).	SP	11
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ANG, ~10% SLT & CL, SAT, GR. BRN. (10YR 5/2).	SP	10
		14-16	SAND, AS ABOVE.	SP.	4



Water and Air Research, Inc. SHEET 1 OF 1

Boring No.	AP 7-1	Location Coordinates	1,209,799.18 N 711,901.30 E
Hole Size	8" x 15 FT Slot 0.010"	Filter Materials	20-30 SAND
Screen Size	2" x 10 FT Mat'l SCH 40 PVC	Grout Type	2:1 SAND CEMENT
Casing Size	2" x 7.5 FT Mat'l SCH 40 PVC	Protective Casing	6" x 5' BIP
Geologist	W. D. ADAMS	Static Water Level	
Date Start	27 SE 83 Finish 27 SE 83	Top of Well Elevation	63.99 FT MSL
Contractor	WAR/PTL	Drill Type	CME-55; 8" HSA
Driller	P. SCHUMATE		



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, TR HVY MIN, ANG, TR SLT & CL, TR O.M., DRY, LT. GRAY (10 YR 7/1).	SP	N.A.
		4-6	4-5: CLAY, SANDY. CL c̄ ~20% VF-F SD, QTZ, STIFF, SAT, DK. GRAY (5 Y 4/1).	CL	16
			5-6: SAND, CLAYEY. SD, VF-F, QTZ, ANG, ~20% SLT & CL, SAT, DK. GRAY. BRN. (2.5 Y 4/2).	SC	
		9-11	9-10: SAND, CLAYEY. SD, VF-F, QTZ, ~40% SLT & CL, STIFF, SAT, GRAY. BRN. (2.5 Y 5/2).	SC-CL	15
			10-11: SAND, VF-F, QTZ, ANG, ~10% SLT & CL, SAT, SOFT, LT. GRAY (10 YR 7/2).	SP-SC	
		14-16	SAND, AS ABOVE EXCEPT ~20% SLT & CL, STIFF, GRAY (5 Y 6/1).	SP-SC	8

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 7-2

Location Coordinates 1,209,913.36 N
711,578.48 E

Hole Size 8" x 15' Slot 0.010"

Screen Size 2" x 10' Mat'l PVC, SCH 40

Filter Materials 20-30 SAND

Casing Size 2" x 7.5' Mat'l PVC, SCH 40

Grout Type SAND-CEMENT (2:1)

Geologist W. D. ADAMS

Protective Casing 6" x 5' B.I.P.

Date Start 27 SE 83 Finish 27 SE 83

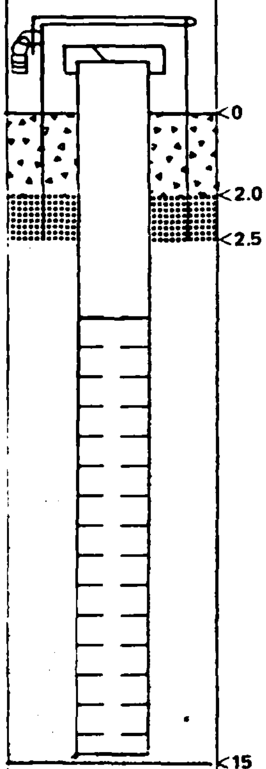
Static Water Level

Contractor WAR / PTL

Top of Well Elevation 63.65 FT MSL

Driller P. SCHUMATE

Drill Type 8" HSA ; CME-55



Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, ANG, TR SLT & CL, TR O.M., DRY, LT GRAY (10YR 7/1).	SP	N.A.
		4-6	CLAY, STIFF, c̄ ~10% VF QTZ SD & SLT, MOIST, RED-YEL (7.5YR 6/8) AND GRAY (10YR 5/8).	CL	15
		9-11	9-10: SAND, CLAYEY SD, VF-F, QTZ, ANG, ~20% SLT & CL, STIFF, MOIST, GRAY (5Y 5/1) STREAKED c̄ RED-YEL (7.5YR 7/8).	SC-CL	11
			10-11: SAND, VF-F, QTZ, TR HVY MIN, ANG, ~10% SLT & CL, SAT., GRAY (5Y 6/1).	SP	
		14-16	SAND, AS ABOVE.	SP	5

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 7-3

Hole Size 8" x 15' Slot 0.010"

Screen Size 2" x 10' Mat'l PVC, SCH 40

Casing Size 2" x 7.5' Mat'l PVC, SCH 40

Geologist W. D. ADAMS

Date Start 26 SEP 93 Finish 26 SEP 93

Contractor WAR/PTL

Driller P. SCHUMATE

Location Coordinates 1,209,366.73

711,455.17E

Filter Materials 20-30 SAND

Grout Type SAND CEMENT (2:1)

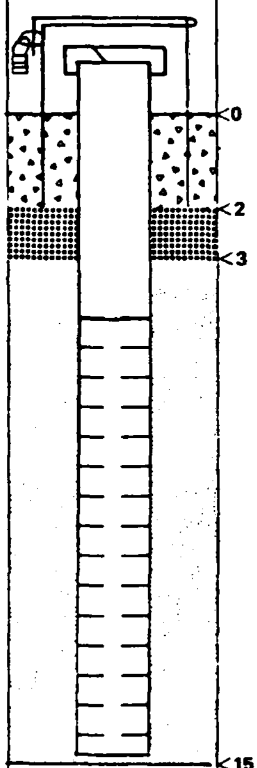
Protective Casing 6" x 5' IRON

Static Water Level

Top of Well Elevation 64.45 FT MSL

Drill Type 8" HSA; CME-55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-M, QTZ, ANG, TR SLT & CL, TR OM. MOIST, BLACK (10YR 2/1).	SP	N.A.
		4-6	4-5.5: SAND, SAME AS ABOVE. 5.5-6: CLAY, SANDY. CL, 0 ~ 35% VF-F, QTZ SD, STIFF, WET, YELLOW (10 YR 7/8) & GR BRN (2.5Y 4/2).	SP CL-SC	4
		9-11	SAND, VF-F, QTZ, TR HVY MIN, ANG, ~10% SLT & CL, SAT, LT. GRAY (5Y 7/1).	SP	10
		14-16	SAND, AS ABOVE.	SP	4

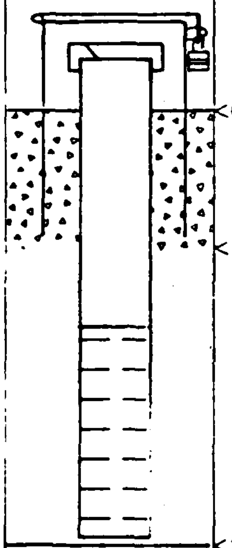


Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 11-1
Hole Size 8" x 10FT Slot 0.010"
Screen Size 2" x 4.7' Mat'l PVC, SCH 40
Casing Size 2" x 7.5' Mat'l PVC, SCH 40
Geologist W. D. ADAMS
Date Start 26 SEP 83 Finish 26 SEP 83
Contractor WAR/PTL
Driller P. SCHUMATE.

Location Coordinates 1,210,125.64 N
710,367.08 E
Filter Materials 20-30 SAND
Grout Type SAND - CEMENT (2:1)
Protective Casing 6" x 5 FT B.I.P.
Static Water Level
Top of Well Elevation 61.74 FT MSL
Drill Type 8" HSA; CME 55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, ANG, ~5% M-CRS, QTZ, ANG SD, TR SLT & CL, TR OM, DRY, LT GRAY (10 YR 6/1).	SP	N.A.
		4-6	4-5.5: SAND, VF-M, QTZ, SUB-ROUND, ~10% SLT & CL, MOIST, V. DK GRAY (2.5Y N3/). 5.5-6: CLAY, SANDY. CL c̄ ~30% VF-F, QTZ SD, MOIST, RED-YEL. (7.5 YR 7/8) MOTTLED c̄ DK GRAY (5Y 4/1).	SP-SC CL-SC	4 3
		9-11	SAND, CLAYEY. SD, VF-M, QTZ, ANG, ~20% SLT & CL, WET, ~~V~~. DK. GRAY (5Y 4/1).	SC	7

Water and Air Research, Inc.

SHEET 1 OF 1

Boring No. AP 11-2

Location Coordinates 1,210,273.61 N

710,267.95 E

Hole Size 8" x 10 FT Slot 0.010"

Screen Size 2" x 5' Mat'l PVC; SCH 40

Filter Materials 20-30 SAND

Casing Size 2" x 7.5' Mat'l PVC; SCH 40

Grout Type SAND-CEMENT (2:1)

Geologist W. D. ADAMS

Protective Casing 6" x 5' IRON

Date Start 26 SE 83 Finish 26 SEP 83

Static Water Level

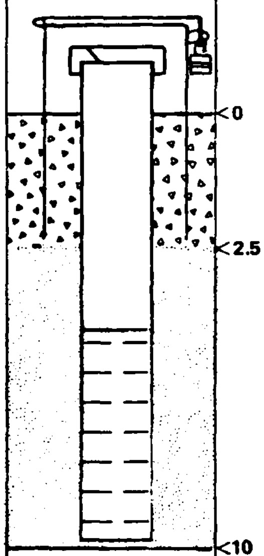
Contractor WAR/PTL

Top of Well Elevation 62.55 FT MSL

Driller P. SCHUMATE.

Drill Type CME-55, 8" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, VF-F, QTZ, ANG, TR SLT & CL, TR OM, DRY, GRAY (10YR6/1).	SP	N.A.
		4-6	CLAY, SANDY. CL c̄ ~ 40% VF-F QTZ SD, STIFF, MOIST, GRAY-BRN (2.5Y 5/2) c̄ RED-YEL (7.5YR 7/8).	SC-CL	4
		9-11	SAND, CLAYEY. SD, VF-F, QTZ, ANG, ~ 20% SLT & CL, MOIST, GRAY (5Y 5/1).	SC	11



APPENDIX E

QUALITY ASSURANCE/QUALITY CONTROL PLAN

APPENDIX E

QUALITY ASSURANCE/QUALITY CONTROL PLAN

E-1.0 ANALYTICAL QUALITY CONTROL

All field sampling and quality control spiking was performed by WAR. All sample analyses, with the exception of TOX, were performed by Technical Services, Inc. (TSI). TOX analyses were performed by Utah Biomedical Testing Laboratory (UBTL). Each of the above organizations maintains a strict quality assurance/quality control (QA/QC) plan which is outlined in a separate document. These QA/QC documents were not appended in this report due to their length. This appendix outlines QA/QC procedures directly relevant to the MacDill AFB Phase IIb survey.

Accuracy of analytical techniques is assured by strict adherence to the methods listed in Table E-1. Integrity and representativeness of the sample are assured by sampling procedures described in Section E-2.0. A check on analytical quality control was provided by duplicating a minimum of 10 percent of the samples in each analysis lot. Additional samples were collected to provide for spiking 10 percent of total phenolics, lead, pesticides, and PCBs samples. Samples for TOC, TOX, oil and grease, VOA, and VOH were not spiked. Duplicate and spike samples were labeled in such a way that the analytical laboratory could not identify them. Results of duplicate and spike analyses are shown in Table E-2.

Inductively Coupled Plasma Spectrometry (ICP) was used for lead analyses in an effort to minimize matrix interferences that impact ICP less than atomic absorption spectrophotometry. Use of ICP resulted in a detection limit of 30 ug/l instead of 20 ug/l as specified in the scope of work. Since a diversity of matrix interferences were anticipated, the ICP method was believed to be capable of providing better quality data that would outweigh the slightly higher detection limit. The 30 ug/l detection limit attained is well below the 50 ug/l MCL for lead.

Table E-1. Analytical Chemistry Methods for Water Samples, MacDill AFB

Parameter	Method	Detection Limit
pH*	EPA 150.1	—
Specific conductance*	EPA 120.1	—
Temperature*	EPA 170.1	—
Organic carbon	EPA 415.1	1 mg/l
Total organic halide	EPA 9020†	10
Oil and grease	EPA 413.2	0.1 mg/l
Total phenolics	EPA 420.1	1
Organochlorine pesticides	EPA 608††	—
Lindane	EPA 608††	0.01
Aldrin	EPA 608††	0.02
Heptachlor	EPA 608††	0.02
Heptachlor epoxide	EPA 608††	0.02
Dieldrin	EPA 608††	0.02
Endrin	EPA 608††	0.02
DDT isomers	EPA 608††	0.02 each
Methoxychlor	EPA 608††	0.20
PCBs	EPA 608††	0.25
Lead	EPA 200.7	30
VOH	EPA 601††	**
VOA	EPA 602††	**

All detection limits are in ug/l units except where noted.

Note: EPA = U.S. EPA "Methods for Chemical Analysis of Water and Wastes," March 1979—Method Number.

*Performed at the time of sample collection.
†EPA = EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 2nd Edition, 1982.
**See Table 12 for detection limits.
††EPA = EPA "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", July 1982—Method Number.

Table E-2. MacDill AFB Spike Data

Station	Analyte	Unspiked Sample Conc.*	Calc. Spike Conc.*	Observed Spiked Sample Conc.*	Percent Recovery†
AP 7-3	Phenolics	11	10.4	18	67
MD 58-1	Phenolics	10	26	44	131
AP 7-3	Aldrin	<0.02	0.148	0.04	27
NA	Aldrin	NA	0.148	0.16	108
AP 7-3	Heptachlor	<0.02	0.150	0.13	86
NA	Epoxide	NA	0.150	0.19	126
AP 7-3	DDT-R	<0.02	1.72	0.03	<2
NA	DDT-R	NA	1.72	0.12	7
MD 3-5	PCB (as	<0.25	2.68	<0.25	<5
NA	Aroclor 1248)	NA	2.76	2.71	98
MD 23-3	Dissolved lead	<30	46.6	49	105
MD 16-6	Dissolved lead	<30	109	90	82

*Measured in ug/l.

†Percent Recovery = $\frac{\text{(obs. spike sample conc. - unspiked sample conc.)}}{\text{Calc. spike conc.}} \times 100$

NA = Not applicable--deionized water spike.

E-1.1 OIL AND GREASE

Duplicates--10.2, 1.6 mg/l Mean--5.9 mg/l

No spike

As stated in the discussion of results, due to the nature of the sampling large amounts of silt and sand were present in the samples and could have impacted the precision of the analysis.

E-1.2 TOTAL PHENOLICS

Duplicates--12, 7 ug/l Mean--9.5 ug/l

Duplicates--12, 10 ug/l Mean--11 ug/l

Spike recoveries were 67 percent and 131 percent at levels of 10 and 26 ug/l, respectively.

Duplication of these samples was acceptable for the type of matrices involved; however, the spike recoveries were not as close as desired or as close as those of previous sampling efforts (e.g., Eglin AFB). Matrix interference could be involved in the deviation from total recovery.

E-1.3 DOC

Duplicates--45, 62 mg/l Mean--53.5 mg/l

Duplicates--21, 11 mg/l Mean--16 mg/l

Duplicates--<1, <1 mg/l Mean--<1 mg/l

No spike

Duplication of these samples was acceptable for the type of matrices involved.

E-1.4 TOX

Duplicates--110, 150 ug/l Mean--130 ug/l

Duplicates--40, 40 ug/l

No spike

Duplication of these samples was acceptable for the type of matrices involved.

E-1.5 LEAD (DISSOLVED)

Duplicates--<30, <30 ug/l

Duplicates--35, <30 ug/l

Spike recoveries were 105 percent and 82 percent at levels of 47 and 109 ug/l, respectively.

Duplication and spike recoveries for these samples are satisfactory.

E-1.6 PURGEABLES

Duplicates--Compounds detected

1,1-Dichloroethene	ND, 2 ug/l
t-1,2-Dichloroethene	110, 164 ug/l
Methylene chloride	ND, 180 ug/l
1,1,1-Trichloroethane	2, 31 ug/l
Trichloroethene	96, 1 ug/l
Benzene	33, 17 ug/l
Ethyl benzene	109, 238 ug/l
Toluene	341, 578 ug/l

No spike

Volatiles analyses are perhaps the most difficult trace organic analyses from which to obtain consistent duplication and recoveries. Compounding this problem is the possibility of a nonhomogeneous matrix, such as a biphasic system, which prevents representative duplicate sampling. In view of these observations, some of the results in the above table reflect the difficulty of the analytical situation. However, the bulk of the results is satisfactory for the sample condition.

E-1.7 PCBs/PESTICIDES

PCBs Duplicates--<0.25, <0.25 ug/l

Spike recoveries were <5 and 98 percent at a level of approximately 3 ug/l.

Pesticide Duplicates--All compounds below detection limit except DDT-R, <0.02, 0.03 ug/l. See Table E-2 for spike recoveries on individual pesticides.

The duplication for PCBs and pesticides was nearly exact. However, there is some question concerning the precision of the analysis due to a sampling problem. Samples were taken in 1-gallon, amber glass jugs from which aliquots were taken for analysis. Duplicate spiking analysis of real samples and a clean matrix (deionized water) showed evidence of a recovery problem associated with the real sample matrix (see Table E-2). Sediment present in the bottom of the sample containers is suspected of contributing to the poor recoveries.

E-2.0 SAMPLING INSTRUCTIONS FOR MACDILL AFB

Descriptions of sample containers, preservation methods, and holding times are given in Table E-3. Sampling procedures are outlined below for each analysis group.

E-2.1 PURGEABLE ORGANICS

This sample should come from the first aliquot of a bailer to prevent the loss of any volatiles. Avoid excess turbulence (e.g., bubbling) when filling these bottles for the same reason. Fill bottle to an inverted meniscus, cap, and refrigerate immediately. A small convex dimple in the top of the septum indicates that the bottle is properly filled. There should be no air bubbles present in the bottle. This sample is taken in triplicate in 40-milliliter glass, screw-cap vials with Teflon™ septa. Preservation is by refrigeration.

Table E-3. Sample Containers, Preservation Methods, and Holding Times

Parameter	Sample Type	Container/ Volume	Method of Preservation (Filtration, pH, etc.)	Holding Time
Oil and grease	W*	Glass, 1 qt.	Conc. HCl to pH <2, chill to 4°C	28 days
Phenols	W	Glass, 1 qt.	Conc. H_3PO_4 to pH <2, 1 gram $CuSO_4$/L, chill to 4°C	28 days
Lead (diss.)	W	Plastic, 4 oz.	Filter, conc. HNO_3 to pH <2	6 months
TOX	W	Glass, 40 ml (2) Teflon septa	No headspace in vial, chill to 4°C	14 days
DOC	W	Plastic, 4 oz.	Filter, conc. HCl to pH <2, chill to 4°C	28 days
Purgeables	W	Glass, 40 ml (3) Teflon septa	No headspace in vial, chill to 4°C	14 days
Pesticides/ PCBs	W	Glass, 1 gal.	Chill to 4°C	7 days extraction, 40 days analysis

*W = Water

Source: EPA, 1982.

E-2.2 METALS

Metal samples from the wells should be from the first bailer (1 liter). The bottle should be filled to the very top if dissolved metals are desired and filtration is not performed immediately.

Filtration should be as follows:

1. Rinse a glass fiber filter with 20 to 30 milliliters of 0.5 N HNO_3 after placing the filter in the suction apparatus. Discard the rinsate.
2. Rinse the filter with 20 to 30 milliliters of sample. Discard the rinsate.
3. Filter the sample and return it to the bottle after rinsing the bottle with deionized water.
4. For membrane filtration, place the filter in the filtration apparatus with the gridded side up and follow Steps 1 through 3; preserve the sample with concentrated HNO_3.
5. Samples must be filtered through the 0.45-micrometer filter for analytes to be considered dissolved. Filtration through a glass fiber filter reduces "binding" of the membrane filter but may not be needed for samples with little turbidity.

After filtration, preserve metal samples by adding 2 milliliters of HNO_3 per liter of sample. Mix thoroughly and check the pH by pouring a small amount of the sample on a pH test strip. If the pH is not less than 2, add more HNO_3. Refrigeration of preserved metals samples is not necessary.

E-2.3 DOC

Fill the sample bottle completely to ensure sufficient sample after filtration. This procedure is the same as that for metals except 5 N H_2SO_4 is used for rinsing and concentrated H_2SO_4 is used for preservation. These samples require refrigeration.

E-2.4 OIL AND GREASE

Due to the nature of analyte, do not fill sample bottles completely. Bottles are 1-liter amber glass with foil-lined caps. Preserve oil and grease samples by adjusting the pH below 2 with concentrated HCl and refrigerating the sample.

E-2.5 PHENOLICS

Do not fill bottles completely in order to leave room for spiking purposes. Preserve with concentrated H_3PO_4 (using disposable glass pipets) to a pH <2. Add 1 gram of $CuSO_4$ per liter of sample. Refrigerate after acidification.

E-2.6 TOX

The procedure is the same as that used for purgeable organics except the sample is taken in duplicate.

E-2.7 PCBs/PESTICIDES

Use 1-gallon amber glass jugs with foil-lined caps for PCBs/pesticides samples. Take care in sampling surface waters to prevent inclusion of excessive amounts of silt and debris disturbed from the bottom of the site. Preserve these samples by refrigeration.

E-2.8 pH AND SPECIFIC CONDUCTANCE

Meters were standardized daily in the field using solutions prepared in the WAR laboratory. Back-up meters and solutions were available at all times in the company vehicle on-site.

APPENDIX F

FIELD DATA SHEETS

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1705

Sampling Site/Well No.: MD 16-1

Sampling Location Description: FUEL TANK FARM - ~~EAST~~ NORTH SIDE
~~SOUTHERN~~ EAST PIT WELL

Groundwater Samples

Depth to water surface 2'0"

Height of water column ______

pH 6.6

Sp. cond. 281 @ 19.5°C

~~Surface Water and Sediment Samples~~

~~Total Depth ______~~

~~Sample Depth(s) ______~~

~~pH ______~~

~~Sp. cond. ______~~

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15063	1 qt. glass	Oil & Grease ✓	HCl to pH<2,4°C	OG 10
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
↓	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2,4°C	PB 12
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

15065

Comments and additional observations: ______

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc. 6821 S.W. Archer Road P.O. Box 1121 Gainesville, FL 32602 Phone: 904/372-1500	Project: ______ Project No.: ______ Sampled by: RDB / JWR Date: 11/18/83 Time: 1720

Sampling Site/Well No.: M016-2

Sampling Location Description: FUEL TANK FARM - ~~EAST~~ NORTH SIDE
~~NORTHERN~~ WEST PIT WELL

Groundwater Samples		~~Surface Water and Sediment Samples~~	
Depth to water surface	2' 4"	Total Depth	
Height of water column		Sample Depth(s)	
pH	6.0	pH	
Sp. cond.	230 @ 20°C	Sp. cond.	

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15064	1 qt. glass	Oil & Grease ✓	HCl to pH<2,4°C	OG 11
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
↓	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2,4°C	PB 13
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15064

Comments and additional observations: ______

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: ROB/JWR
Date: 11/18/83
Time: 1730

Sampling Site/Well No.: MD 16-3

Sampling Location Description: FUEL TANK FARM - WEST SIDE NORTHERN WELL

Groundwater Samples

Depth to water surface 1'1"

Height of water column ______

pH 6.1

Sp. cond. 308 @ 18.5°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

#15065

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15065	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	OG 7
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
↓	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2, 4°C	PB 18
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: ______

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1735

Sampling Site/Well No.: MD 16-4

Sampling Location Description: FUEL TANK FARM - WEST SIDE SOUTHERN WELL

Groundwater Samples

Depth to water surface 1'10"

Height of water column ______

pH 6.3

Sp. cond. 1810 @ 21°C

~~Surface Water and Sediment Samples~~

~~Total Depth ______~~

~~Sample Depth(s) ______~~

~~pH ______~~

~~Sp. cond. ______~~

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15066	1 qt. glass	Oil & Grease ✓	HCl to pH<2,4°C	OG 8
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
↓	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2,4°C	PB 14
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15066

Comments and additional observations: [illegible]

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1740

Sampling Site/Well No.: MD16-5

Sampling Location Description: FUEL TANK FARM - SOUTH SIDE WESTERN PIT WELL

Groundwater Samples

Depth to water surface 3'4"

Height of water column ____

pH 6.0

Sp. cond. 200 @ 17°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15067	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	OG9
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2, 4°C	PB21
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15067

Comments and additional observations: ____

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1750

Sampling Site/Well No.: MD16-6

Sampling Location Description: FUEL TANK FARM - SOUTH SIDE EASTERN PIT WELL

Groundwater Samples

Depth to water surface 2'6"

Height of water column ______

pH 6.1

Sp. cond. 271 @ 19°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15068, 15073	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	OG 6, 5
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2, 4°C	PB 15, 11
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15068

15073

PB-19 split 15073

Comments and additional observations: ______

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB / JWR
Date: 11/18/83
Time: 1800

Sampling Site/Well No.: MD16-7

Sampling Location Description: FUEL TANK FARM - EAST SIDE SOUTHERN WELL

Groundwater Samples

Depth to water surface 2'3"

Height of water column ______

pH 6.4

Sp. cond. 425 @ 17°C

~~Surface Water and Sediment Samples~~

~~Total Depth ______~~

~~Sample Depth(s) ______~~

~~pH ______~~

~~Sp. cond. ______~~

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
15069	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	OG 4
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
↓	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2, 4°C	PB 20
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15069

Comments and additional observations: CAVED IN VERY BADLY

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

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Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1815

Sampling Site/Well No.: MD 16-8
Sampling Location Description: ____

Groundwater Samples		Surface Water and Sediment Samples	
Depth to water surface		Total Depth	
Height of water column		Sample Depth(s)	
pH		pH	
Sp. cond.		Sp. cond.	

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	OG 1
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	PB 16
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

~~#16~~

not collected

Comments and additional observations: NO SAMPLE - HOLE CAVED IN CONSTANTLY AT WATER TABLE

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1220

Sampling Site/Well No.: MD3-1

Sampling Location Description: SITE 3 - LANDFILL AT DOG KENNEL, WELL NEAREST KENNEL.

Groundwater Samples

Depth to water surface 5'9½"

Height of water column ______

pH 6.6

Sp. cond. 3180 @ 23°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15050	1 qt. glass	Pesticides PCBs ✓	Chill to 4°C	PCB 9
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X39,40 / TOC 18
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15050

Comments and additional observations: BAILED DRY @ 6L.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
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Phone: 904/372-1500

Project: ____________
Project No.: ____________
Sampled by: RDB / JWR
Date: 11/18/83
Time: 1205

Sampling Site/Well No.: MD3-2

Sampling Location Description: SITE 3 - LANDFILL AT DOG KENNEL, WELL IN CORNER OF SW BOUNDARY (DITCH).

Groundwater Samples

Depth to water surface 5'6¼"

Height of water column ____________

pH 6.8

Sp. cond. 3550 @ 23.5°C

~~Surface Water and Sediment Samples~~

Total Depth ____________

Sample Depth(s) ____________

pH ____________

Sp. cond. ____________

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.	
		Water Samples			
15051	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	PCB 8	
	1 qt. glass	Herbicides	Chill to 4°C		#15051
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C		
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C		
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C		
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X37,38 / TOC 1	
	2 oz. glass	Purgeables	Chill to 4°C	PO 7	
		Sediment Samples			
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C		

Comments and additional observations: BAILED DRY @ 6 L.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1235

Sampling Site/Well No.: MD ~~8~~3-3

Sampling Location Description: SITE 3 - LANDFILL AT DOG KENNEL, WELL ON DRAINAGE DITCH TRANSECTING IRR. FIELD #2.

Groundwater Samples

Depth to water surface 4' 11½"

Height of water column ____

pH 6.8

Sp. cond. 1150 @ 23.5°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.	
		Water Samples			
15052	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	PCB 10	#15052
↓	1 qt. glass	Herbicides	Chill to 4°C		
↓	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C		
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C		
↓	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C		
↓	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X41, 42	/ TOC 20
	2 oz. glass	Purgeables	Chill to 4°C		
		Sediment Samples			
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C		

Comments and additional observations: BAILED DRY @ 5L.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ________
Project No.: ________
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1300

Sampling Site/Well No.: MD 3-4

Sampling Location Description: SITE 3 - EXISTING WELL PT. #3 ON BOUNDARY OF GOLF COURSE & IRR. FIELD #4

Groundwater Samples

Depth to water surface 2' 3 3/4"

Height of water column ________

pH 6.4

Sp. cond. 1780 @ 24°C

~~Surface Water and Sediment Samples~~

~~Total Depth~~ ________

~~Sample Depth(s)~~ ________

~~pH~~ ________

~~Sp. cond.~~ ________

#15053

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15053	1 qt. glass	Pesticides, PCBs	Chill to 4°C	PCB 11
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X43, 44 / TOC 21
	2 oz. glass	Purgeables	Chill to 4°C	PO 5
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30L BEFORE SAMPLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/8/83
Time: 1335

Sampling Site/Well No.: MD 3-5

Sampling Location Description: SITE 3 - EXISTING WELL PT. #4 ON BOUNDARY OF GOLF COURSE AND IRR. FIELD #4

Groundwater Samples

Depth to water surface 5'0"

Height of water column ______

pH 5.1

Sp. cond. 278 @ 25°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

15054

#15054 15055 15056

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	PCB 12, 13, 14
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X 45, 46, 47 TOC 23
	2 oz. glass	Purgeables	Chill to 4°C	BROKEN
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30 L BEFORE SAMPLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: 11/18/83
Date: RDB/JWR
Time: 1040

Sampling Site/Well No.: MD 58-1

Sampling Location Description: ZONE 3 - NEXT TO CREEK/ DRAINAGE CANAL, EASTERN END

Groundwater Samples

Depth to water surface 6' ½"

Height of water column ______

pH 6.6

Sp. cond. 2940 @ 25°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	#15041 #15042 #15043
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
15041, 15042, 15043	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 11/12/13
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC	Chill to 4°C, H_2SO_4 to pH <2	X27-30 29 28 / TOC 1 / TOC 7
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30 L BEFORE SAMPLING. WATER TURBID (SANDY), YELLOW-BRN & FOUL SMELLING. FOAMED SLIGHTLY WHEN BEING POURED IN BUCKET.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____________
Project No.: ____________
Sampled by: RDB / JWR
Date: 11/18/83
Time: 1020

Sampling Site/Well No.: MD 58 - 2

Sampling Location Description: ZONE 3 - BOUNDARY OF E.O.D. RANGE, NEXT TO DRAINAGE DITCH / CREEK

Groundwater Samples

Depth to water surface 6' 1/4"

Height of water column ____________

pH 5.1

Sp. cond. 770 @ 24°C

Surface Water and Sediment Samples

Total Depth ____________

Sample Depth(s) ____________

pH ____________

Sp. cond. ____________

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.	
		Water Samples			
	1 qt. glass	Pesticides, PCBs	Chill to 4°C		~~15044~~
	1 qt. glass	Herbicides	Chill to 4°C		# 15-044
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C		
15044	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	TP 10	
↓	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C		
↓	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X25,26 / TOC 11	
	2 oz. glass	Purgeables	Chill to 4°C		
		Sediment Samples			
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C		

Comments and additional observations: BAILED 30 L BEFORE SAMPLING. WATER SLIGHTLY TURBID, YELLOW-BRN. IN COLOR, FOUL SMELLING (SEWER ODOR).

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1000

Sampling Site/Well No.: MD58-3

Sampling Location Description: ZONE 3 - E.O.D. RANGE, NEXT TO CREEK

Groundwater Samples		~~Surface Water and Sediment Samples~~	
Depth to water surface	6'10½"	Total Depth	
Height of water column		Sample Depth(s)	
pH	5.6	pH	
Sp. cond.	313 @ 24.5°C	Sp. cond.	

#15045

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
15045	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	TP 9
↓	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
↓	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X23, 24 / TOC 3
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 15 L BEFORE SAMPLING. WATER SAME AS 58-4 IN APPEARANCE.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 0930

Sampling Site/Well No.: MD58-4

Sampling Location Description: ZONE 3 - ~~E.O.D. RA~~ OLD DUMP AREA, NEXT TO CREEK/DITCH.

Groundwater Samples		Surface Water and Sediment Samples	
Depth to water surface	7' 7"	Total Depth	
Height of water column		Sample Depth(s)	
pH	6.2	pH	
Sp. cond.	1990 @ 25.5°C	Sp. cond.	

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
15046	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	TP 8
	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X21,22 / TOC 22
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

15046

Comments and additional observations: BAILED 30L BEFORE SAMPLING. WATER TURBID (SANDY) & FOUL SMELLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1140

Sampling Site/Well No.: MD9-1

Sampling Location Description: SITE 9 - CURRENT LANDFILL, ~30 FT. FROM BROAD CREEK

Groundwater Samples

Depth to water surface 3' 11"

Height of water column ______

pH 7.0

Sp. cond. 6,000 @ 24°C

~~Surface Water and Sediment Samples~~

~~Total Depth ______~~

~~Sample Depth(s) ______~~

~~pH ______~~

~~Sp. cond. ______~~

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	#15047
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
15047	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 16
↓	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
↓	2 oz. plastic	TOX/TOC	Chill to 4°C, H_2SO_4 to pH <2	X35, 36 / TOC 1
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 10 L. BEFORE SAMPLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RAB/JWR
Date: 11/18/83
Time: 1125

Sampling Site/Well No.: MD9-2

Sampling Location Description: SITE 9 - CURRENT LANDFILL, ~15-20 FT. FROM DREDGED CANAL JOINING BROAD CREEK

Groundwater Samples

Depth to water surface 4' 1½"

Height of water column ____

pH 6.8

Sp. cond. 11,200 @ 24°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
15048	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	TP 15
↓	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
↓	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X33,34 / TOC 13
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

H15048

Comments and additional observations: BAILED 30 L BEFORE SAMPLING. WATER SLIGHTLY LESS TURBID & COLORED THAN 9-3

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1110

Sampling Site/Well No.: MD9-3

Sampling Location Description: SITE 9 - CURRENT LANDFILL, ~200 YD. NORTH OF 9-2 ON CANAL.

Groundwater Samples

Depth to water surface 4'11½"

Height of water column ______

pH 6.7

Sp. cond. 14,900 @ 23.5°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
15049	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	TP 14
	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X31, 32 / TOC 1
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15049

Comments and additional observations: BAILED 13L BEFORE SAMPLING. WATER TURBID, DK. GREY-BLK, FOUL SMELLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

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6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: ROB / JWR
Date: 11/17/83
Time: 1645

Sampling Site/Well No.: MD 17 - 1

Sampling Location Description: DRUM STORAGE AREA SOUTHERNMOST WELL, ACROSS DITCH 25-30' FROM PERIMETER RD. IN GRASSY FIELD.

Groundwater Samples		Surface Water and Sediment Samples	
Depth to water surface	6' 11"	Total Depth	
Height of water column		Sample Depth(s)	
pH	5.0	pH	
Sp. cond.	76 @ 25°C	Sp. cond.	

#15039

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15039	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	PCB 7
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 7
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
15071 QC	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X17 - 20 (19) 18 / TOC 14 #15071 16
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30L BEFORE SAMPLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1620

Sampling Site/Well No.: MD 17-2

Sampling Location Description: DRUM STORAGE AREA NORTHERNMOST WELL

Groundwater Samples

Depth to water surface 5'4"

Height of water column ____

pH 5.2

Sp. cond. 190 @ 25°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

#15040

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15040	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	PCB 6
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 6
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X15, 16 / TOC 9
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30 L BEFORE SAMPLING. WATER TURBID, GREY-BRN., FOUL SMELLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1415

Sampling Site/Well No.: MD 23-1

Sampling Location Description: SITE 23, NW TRAINING AREA NEXT TO ABANDONED, WRECKED CARS

Groundwater Samples

Depth to water surface 9' 1½"

Height of water column ____

pH 6.2

Sp. cond. 550 @ 25°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

#15057

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
15057	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2, 4°C	PB 1
↓	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X 48, 49 / TOC 24
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30L BEFORE SAMPLING. WATER TURBID & FOAMY, YELLOW-BRN, FUEL ODOR.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project:
Project No.:
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1445

Sampling Site/Well No.: MD 23-2

Sampling Location Description: SITE 23 - NW TRAINING AREA, WESTERNMOST WELL

Groundwater Samples

Depth to water surface 10' ½"

Height of water column

pH 6.0

Sp. cond. 790 @ 25°C

Surface Water and Sediment Samples

Total Depth

Sample Depth(s)

pH

Sp. cond.

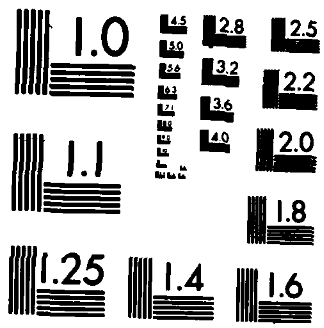
Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	# 15058
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
15058	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	PB 2
↓	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X 50, 51 / TOC 25
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED DRY @ 7 L. WATER FOAMY, FUEL ODOR & DECAY-TYPE ODOR, TURBID, GREY-BRN.

AD-A147 283 INSTALLATION RESTORATION PROGRAM PHASE II--CONFIRMATION/QUANTIFICATION ST..(U) WATER AND AIR RESEARCH INC GAINESVILLE FL W D ADAMS ET AL. SEP 84 3/3

UNCLASSIFIED 7166-090 F33615-81-D-4007 F/G 13/2 NL

END


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB / JWR
Date: 11/18/83
Time: 1455

Sampling Site/Well No.: MD 23-3

Sampling Location Description: SITE 23 - NW TRAINING AREA, SOUTH OF PLANE HULL

Groundwater Samples

Depth to water surface 9'9" - 2'4½"

Height of water column ______

pH 6.3

Sp. cond. 415 @ 26°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.	
		Water Samples			
	1 qt. glass	Pesticides, PCBs	Chill to 4°C		#15059
	1 qt. glass	Herbicides	Chill to 4°C		Spk 4 (15070)
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C		
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C		# 15072
[illegible]	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	PB 6, 4	PB 17
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X52,53	/ TOC 26
[illegible]	2 oz. glass	Purgeables	Chill to 4°C	PO 4,	8 #15074
		Sediment Samples			
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C		

Comments and additional observations: BAILED DRY @ 8 L.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.	Project:
6821 S.W. Archer Road	Project No.:
P.O. Box 1121	Sampled by: RDB / JWR
Gainesville, FL 32602	Date: 11/18/83
Phone: 904/372-1500	Time: 1530

Sampling Site/Well No.: MD 23 - 4

Sampling Location Description: SITE 23 - SE TRAINING AREA

Groundwater Samples		Surface Water and Sediment Samples	
Depth to water surface	5' 1½"	Total Depth	
Height of water column		Sample Depth(s)	
pH	6.7	pH	
Sp. cond.	570 @ 25.5°C	Sp. cond.	

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	#15060
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
15060	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	PB 8
↓	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X54, 55 / TOC 27
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 30L BEFORE SAMPLING. WATER TURBID (SANDY) & GREY-BRN.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB / JWR
Date: 11/18/83
Time: 1545

Sampling Site/Well No.: MD23-5

Sampling Location Description: SITE 23 - SE TRAINING AREA, NORTHERN WELL

Groundwater Samples

Depth to water surface 6' 2½"

Height of water column ____

pH 6.7

Sp. cond. 820 @ 25.5°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
15061	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	PB 9
↓	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X56, 57 / TOC 28
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

#15061

Comments and additional observations: BAILED 30L BEFORE SAMPLING. WATER SAME AS 23-4.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/18/83
Time: 1600

Sampling Site/Well No.: MD 23-6
Sampling Location Description: SITE 23 - SE TRAINING AREA

Groundwater Samples

Depth to water surface 6'4"
Height of water column ______
pH 6.4
Sp. cond. 660 @ 26°C

~~**Surface Water and Sediment Samples**~~

~~Total Depth ______~~
~~Sample Depth(s) ______~~
~~pH ______~~
~~Sp. cond. ______~~

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
15062	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	PB 10
↓	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X58,59 / TOC 29
↓	2 oz. glass	Purgeables	Chill to 4°C	PO 2
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

15062

Comments and additional observations: BAILED 15L BEFORE SAMPLING. WATER TURBID (SANDY), GREY-BRN, VERY FOAMY.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1140

Sampling Site/Well No.: APG-1

Sampling Location Description: ADJACENT TO DRAINAGE CANAL, 100 YD. FROM MAIN RD. INSIDE GATE & FENCE

Groundwater Samples

Depth to water surface 8'8"

Height of water column ______

pH 6.2

Sp. cond. 464 @ 25°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	#15031
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
15031	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2, 4°C	PB3
↓	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X2,3/TOC5
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 25L BEFORE SAMPLING WATER TURBID (LIKE CHOC. MILK).

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project:
Project No.:
Sampled by: RDB / JWR
Date: 11/17/83
Time: 1210

Sampling Site/Well No.: AP6 - 2

Sampling Location Description: ~ 30 FT. OFF ABANDONED RD., SOUTH OF 6-1 & NEAR OLD STABLES.

Groundwater Samples

Depth to water surface 6' 4"

Height of water column

pH 5.8

Sp. cond. 1210 @ 25°C

Surface Water and Sediment Samples

Total Depth

Sample Depth(s)

pH

Sp. cond.

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	#15032
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
15032	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	PBS
↓	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	X5,6 / TOC 4
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 15L BEFORE SAMPLING. WATER LESS TURBID & FOUL SMELLING THAN PREVIOUS TWO.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1100

Sampling Site/Well No.: APG-3

Sampling Location Description: COW PASTURE / OLD LANDFILL 6-8 FT. FROM BARBED-WIRE FENCE, 150-200 YDS. FROM RD.

Groundwater Samples

Depth to water surface 5'11½"

Height of water column ______

pH 5.6

Sp. cond. 176 @ 23.5°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
15033	1 l plastic	Heavy Metals ✓	HNO_3 to pH<2,4°C	PB 7
↓	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X1,4/ TOC 6
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

15033

Comments and additional observations: BAILED 30L BEFORE SAMPLING. WATER TURBID & GREY-BRN., FOUL SMELLING.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1240

Sampling Site/Well No.: AP7-1

Sampling Location Description: CURRENT LANDFILL, OLD RUNWAY AREA

Groundwater Samples

Depth to water surface 5'2"

Height of water column ______

pH 6.2

Sp. cond. 321 @ 22°C

~~**Surface Water and Sediment Samples**~~

~~Total Depth ______~~

~~Sample Depth(s) ______~~

~~pH ______~~

~~Sp. cond. ______~~

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15034	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	PCB 1 #15034
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 1
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X7,8 / TOC 2
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 15L BEFORE SAMPLING. WATER TURBID & BRN. (CHOC. MILK COLORED). NO ODOR.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1300

Sampling Site/Well No.: AP7-2
Sampling Location Description: CURRENT LANDFILL, OLD RUNWAY AREA

Groundwater Samples

Depth to water surface 6'0"
Height of water column ____
pH 5.4
Sp. cond. 206 @ 23°C

Surface Water and Sediment Samples

Total Depth ____
Sample Depth(s) ____
pH ____
Sp. cond. ____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.	
		Water Samples			
15035	1 qt. glass	Pesticides, PCBs	Chill to 4°C	PCB 2	#15035
↓	1 qt. glass	Herbicides	Chill to 4°C		
↓	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C		
↓	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 2	
↓	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C		
↓	2 oz. plastic	TOX/TOC	Chill to 4°C; H_2SO_4 to pH <2	X9,10/	TOC 8
	2 oz. glass	Purgeables	Chill to 4°C		
		Sediment Samples			
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C		

Comments and additional observations: BAILED 15L BEFORE SAMPLING. WATER TURBID & GREY-BRN, NO ODOR.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project:
Project No.:
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1330

Sampling Site/Well No.: AP7-3
Sampling Location Description: CURRENT LANDFILL / OLD RUNWAY AREA

Groundwater Samples		~~Surface Water and Sediment Samples~~	
Depth to water surface	6' 3¼"	Total Depth	
Height of water column		Sample Depth(s)	# 15036
pH	6.1	pH	
Sp. cond.	312 @ 24°C	Sp. cond.	

15037

15038

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	PCB 3, 4, 5
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	TP 3, 4, 5
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC ✓	Chill to 4°C H_2SO_4 to pH <2	X 11-14 -12, 13 / TOC 11 12
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED 25L BEFORE SAMPLING. WATER TURBID & MILKY BRN.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ______
Project No.: ______
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1040

Sampling Site/Well No.: AP11-1

Sampling Location Description: BESIDE CONCRETE STRUCTURE, 5-6' FROM PINE TREE, PESTICIDE RINSEWATER BASIN

Groundwater Samples

Depth to water surface 6'4"

Height of water column ______

pH 5.5

Sp. cond. 130 @ 23°C

Surface Water and Sediment Samples

Total Depth ______

Sample Depth(s) ______

pH ______

Sp. cond. ______

~~15030~~ 15029

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15029	1 qt. glass	Pesticides, PCBs	Chill to 4°C	PCB18
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$,4°C	
	1 l plastic	Heavy Metals	HNO_3 to pH<2,4°C	
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED DRY @ 4-5L. WATER NOT AS TURBID AS #2.

AVON PARK/MACDILL AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Project: ____
Project No.: ____
Sampled by: RDB/JWR
Date: 11/17/83
Time: 1000

Sampling Site/Well No.: AP 11-2

Sampling Location Description: NEXT TO DEPRESSION BEHIND CONCRETE STRUCTURE, PESTICIDE RINSEWATER BASIN

Groundwater Samples

Depth to water surface 7'0"

Height of water column ____

pH 5.5

Sp. cond. 207 @ 24°C

Surface Water and Sediment Samples

Total Depth ____

Sample Depth(s) ____

pH ____

Sp. cond. ____

~~15029~~ #15030

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
		Water Samples		
15030	1 qt. glass	Pesticides, PCBs	Chill to 4°C	PCB 17
	1 qt. glass	Herbicides	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H_3PO_4 to pH<2, 1gm of $CuSO_4$, 4°C	
	1 l plastic	Heavy Metals	HNO_3 to pH<2, 4°C	
	2 oz. plastic	TOX/TOC	Chill to 4°C H_2SO_4 to pH <2	
	2 oz. glass	Purgeables	Chill to 4°C	
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs, Herbicides, Oil & Grease	Chill to 4°C	

Comments and additional observations: BAILED DRY @ 4-5L. WEATHER CONDITIONS - CLEAR & SUNNY, ~~45~~ 45°F WATER WAS TURBID & BROWNISH-GREY.

APPENDIX G
CHAIN OF CUSTODY FORMS

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, J--

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X			15048	TOC
							15049	(samples
							15050	acidified
							15051	and field
							15052	filtered)
							15053	
							15054	
							~~[illegible]~~	
							15057	
							15058	
							15059	
							15060	
							15061	
							15062	
							15071	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burden	11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, J--

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X			15031	TOC
				↓			15032	(samples
							15033	acidified
							15034	and field
							15035	filtered)
							15036	
							15037	
							15039	
							15040	
							15041	
							15042	
							~~140~~ 15044	
							15045	
							15046	
							15047	

Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burton	Date/Time 11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, J--

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required ON ALL
				Water	Air	Sediment		
				X			15034	Phenolics
							15035	(preserved with
							15036	$CuSO_4$ and
							15037	H_3PO_4)
							15038	
							15039	
							15040	
							15041	
							15042	
							15043	
							15044	
							15045	
							15046	
							15047	
							15048	

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Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burden	11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
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Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill PROJECT:	SAMPLERS: (Signature) W.A.R. / R. D. Baker, J..

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required ON ALL
				Water	Air	Sediment		
				X			15049	Phenolics
								(preserved with
								$CuSO_4$ and
								H_3PO_4)

Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: N. C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burden	Date/Time 11/22/83 3:40 PM
Method of Shipment: W.A.R.		

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R. D. Baker, Jr.

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X			15063	Oil and Grease
							15064	by IR
							15065	
							15066	
							15067	
							15068	
							15069	
							15073	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: N. C. HODGE Organization: W. A. R.	Received for Laboratory by: T.S.I. Jason C Burden	11/22/83 3:40 PM

Method of Shipment: W. A. R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, J--

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X			15039	PCB's
							15040	
							15050	
							15051	
							15052	
							15053	
							15054	
							15055	
							15056	
							15076	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burton	11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: Mac Dill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker Jr.

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X		15034		Organochlorine
						15035		Pesticides
						15036		
						15037		
						15038		
						15077		
						15029		
						15030		

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Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:,	
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burden	11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature)
W.A.R. / R.D. Baker, J--

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required ON ALL
				Water	Air	Sediment		
				X			15051	Volatile
							15053	Halocarbons
							15059	
							15062	
							15074	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Organization:	Received by: Organization:	
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Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: James C. Burden T.S.I.	11/22/83 3:40 PM

Method of Shipment: W.A.R.

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Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, Jr.

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X			15059	Volatile
							15062	Aromatics
							15074	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:,	
Relinquished by: N.C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C. Bender	11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, Jr.

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required ON ALL
				Water	Air	Sediment		
				X			15031	Pb (Total)
							15032	(samples
							15033	acidified and
							15057 ~~15034~~	field filtered)
							15058	
							15059	
							15060	
							15061	
							15062	
							15063	
							15064	
							15065	
							15066	
							15067	
							15068	

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Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: N. C. HODGE Organization: W.A.R.	Received for Laboratory by: James C Burden T.S.I.	11/22/83 3:40 PM

Method of Shipment: W.A.R.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature) W.A.R. / R.D. Baker, J...

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
				X			15069	Pb (Total)
							15070	(samples
							15072	acidified and
							15073	field filtered)
							15075	

Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: N. C. HODGE Organization: W.A.R.	Received for Laboratory by: T.S.I. James C Burden	Date/Time 11/22/83 3:40 PM
Method of Shipment: W.A.R.		

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill PROJECT:	SAMPLERS: (Signature)

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required ON ALL
				Water	Air	Sediment		
							15031	TOX
							15032	(collected in
							15033	duplicate, as
							15034	requested)
							15035	
							15036	
							15037	
							15039	
							15040	
							15041	
							15042	
							15044	
							15045	
							15046	
							15047	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Charles R. Fallows Organization: W.A.R.	Received by: Federal Express Organization:	11/22/83 1600
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received for Laboratory by:	Date/Time

Method of Shipment:

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: MacDill
PROJECT:

SAMPLERS: (Signature)

Station Number	Station Location	Date	Time	Sample Type and No. Water	Air	Sediment	WAR Sample No.	Analysis Required ON ALL
							15048	TOX
							15049	(collected in
							15050	duplicates, as
							15051	requested)
							15052	
							15053	
							15055	
							15057	
							15058	
							15059	
							15060	
							15061	
							15062	
							15071	

Relinquished by / Organization	Received by / Organization	Date/Time
Relinquished by: Charles R. Sullivan Organization: W.A.R.	Received by: Federal Organization: Express	1/27/83 1500
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received by: Organization:	
Relinquished by: Organization:	Received for Laboratory by:	

Method of Shipment:

APPENDIX H
RESUMES OF PROJECT STAFF

WILLIAM D. ADAMS

HYDROGEOLOGIST
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Adams is a graduate geologist who has specialized in engineering applications of hydrogeology. His practical experience is strongly oriented toward solving problems of pollutant transport in the subsurface environment.

He works on environmental contamination assessments and hazardous waste management/permitting. He has conducted hydrogeologic work at abandoned hazardous waste sites at DOD installations in Alabama, Florida, North Carolina, Georgia, Virginia, Missouri, and Arizona. At some of these bases, chemical agent disposal was investigated and elaborate health and safety precautions were used.

His project responsibilities have included: assembling and reviewing geologic and geohydrologic literature; quantifying pollutant movement potential using published documents and/or field test data; supervising monitoring well installation; selecting well sites, depths, and casing requirements; specifying rig clean-up procedures; and drafting reports of findings for DOD and regulatory staffs. Mr. Adams has also participated in staff briefings detailing interim and final findings.

He conducted a comprehensive hazardous waste inspection and survey at Pensacola Naval Air Station. Industrial facilities which generate substantial quantities of various wastes were visited and associated personnel debriefed to determine waste generation and handling practices. This information was used in two ways. First, Mr. Adams and his team developed a complete hazardous waste management plan for the entire complex. This ensured compliance with 40 CFR 260-265. A Part B permit application, including revised Part A, was then filed. Facilities permitted included container storage buildings, surface impoundments, and treatment in drying beds. A preliminary design for additional container storage was reviewed and concept design modifications made to ensure RCRA compliance (40 CFR 264). Although numerous tanks were used, all tank usage was reviewed and recommendations were made to alter hazardous waste storage practices. This eliminated the need to permit any tank.

Mr. Adams has also directed field work for installation restoration confirmation studies (Phase 2) at five Air Force Bases, and one Army Ammunition Plant. In these studies, he researched site geology, sited all wells, supervised well installation and development, and collected samples for inorganic and organic constituent analyses.

In another DOD study, Mr. Adams compared two potential depleted uranium burial sites. He planned and supervised the field work, lab work, and report preparation. An important aspect of this study was assessing potential routes of contaminant migration. This work included extensive field and laboratory soils testing and analysis.

Education

M.S.	Geology	University of Florida
B.S.	Geology	University of Florida

Professional Societies

National Water Well Association
Florida Water Well Association

Publications

Author and co-author of several articles and numerous technical reports.

WDA/HAZ.1
2/9/84

ROBERT D. BAKER, JR.

ENVIRONMENTAL CHEMIST
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Baker is a highly skilled organic chemist who has diverse experience in analyzing environmental samples for various organic constituents. Examples of his recent work include:

- o Gas chromatographic (GC) analysis using FID, ECD, NPD, FPD, and Hall ECD and high-pressure liquid chromatographic (HPLC) analysis using variable wavelength UV/visible, fluorescence, and electrochemical detectors; and

- o Developing and testing methods for analysis for determining trace levels of organic contaminants in pesticide industry wastestreams, which included, among other analyses, detecting phenolics and volatiles using GC.

In work related to other pesticide manufacturers, he reviewed and assessed processes for more than 200 compounds. Using plant operating data, he identified possible impurities introduced through raw materials, by-products created from side-reactions, and potential contamination from various solvent media. This work ultimately led to development of pretreatment technologies.

Mr. Baker modified existing methods of analyzing for DDT in natural waters. Modification was necessary to meet extremely low detection limits with rigorous quality control because of low concentrations mandated in drinking water regulations.

Other types of analytic work by Mr. Baker include:

- o Analyzing natural water (river and lake) samples for organics for background EIS data--Georgia, South Carolina, Alabama, and Florida;

- o Analyzing water and sediment samples for low levels of DDT, PCBs, and other organics--Alabama and Virginia;

- o Developing improved techniques to accurately measure volatile hydrocarbon levels in soils--Virginia;

- o Analyzing fish tissue for hazardous waste contamination in blinded samples with better than 90-percent accuracy on duplicates and controls--Alabama;

- o Using HPLC to verify methods for analysis of 16 polynuclear aromatic hydrocarbon compounds and 2 benzidine compounds (wastewater matrix)--Ohio; and

- o Using HPLC to develop methods and analyze for hazardous (munitions) wastes--Louisiana and Texas.

Education

B.S.	Chemistry	Northeast Louisiana University

Professional Societies

American Chemical Society
American Association for the Advancement of Science

RDB/HAZ.1
9/21/83

CHARLES R. FELLOWS

ENVIRONMENTAL CHEMIST
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Fellows is an environmental chemist trained in both field studies and formal laboratory chemistry.

As a member of hazardous waste site investigation teams, Mr. Fellows has conducted interviews regarding past disposal practices, past and present industrial/chemical processes, and the chemical and physical nature of disposed materials. On several occasions he has identified waste sites that posed an immediate concern to human health.

Mr. Fellows is familiar with and has used various appropriate safety procedures and techniques while sampling sites that have received hazardous wastes. He has collected groundwater, surface water, sediment, and leachates for a wide variety of organic, inorganic, and physical analyses. He is experienced in applying site assessment models to evaluate migration and health-threatening potential of chemical wastes at specific disposal sites.

In addition to the procedures mentioned above for collection, preservation, and analysis of various types of samples, he is familiar with the RCRA EP Toxicity Test Procedure, the U.S. Army Corps of Engineers Elutriate Test Procedure, and groundwater monitoring procedures for arsenic, heavy metals and other toxicants.

Mr. Fellows is directly responsible for inorganic chemical analyses. He performs quality assurance checks and often participates in actual laboratory water quality analyses. He recently worked with an industry generating hazardous wastes to develop suitable extraction methods for assessing waste toxicity. He helped to develop wastewater analysis protocols which mitigated interferences from chemicals in battery manufacturing wastes.

He directs sampling of groundwater monitoring wells and participates in developing field sampling networks for both surface waters and groundwaters.

Education

M.S.	Water Chemistry	University of Florida
B.S.	Biology	Eckerd College

Publications

Author and co-author of several articles and technical reports

CRF/HAZ.1
10/20/83

JERRY A. STEINBERG, Ph.D., P.E. — WATER RESOURCES ENGINEER, WATER AND AIR RESEARCH, INC.

Relevant Experience

Dr. Steinberg is an environmental engineer specializing in the management of hazardous wastes and defining pollutant transport. This includes working at abandoned sites, writing hazardous waste management plans, and preparing hazardous waste facility permits. He has worked directly with regulatory agency staff to negotiate types and amounts of information required and compliance schedules on Part B permits.

For the U.S. Navy he conducted hazardous waste inventory surveys at installations in Texas and Florida. He developed hazardous waste management plans for Naval Air Stations at Corpus Christi, Texas; and Pensacola and Jacksonville, Florida. He filed RCRA Part B permit applications for facilities in Georgia, Florida, and Texas. At one or more of these facilities, incinerators, surface impoundments, treatment in tanks, container storage, storage in tanks, and thermal treatment were permitted. Dr. Steinberg has worked on all components for Part B applications. He has developed closure plans, closure costs, preparedness/prevention measures, and contingency plans. Work included developing concept designs for facilities not meeting 40 CFR 264 requirements. Plans for modifying facilities to achieve compliance were developed. He has directed work for the Naval Energy and Environmental Support Activity (NEESA) at three installations assessing environmental contamination potential from hazardous waste disposal. This initial assessment study (IAS) involved bases in Virginia and North Carolina. In addition to directing the project, he actively participated in all technical phases including: archival research, on-site reconnaissance, data assessment, developing recommendations for confirmation or mitigative action, and report preparation.

For the U.S. Air Force, Dr. Steinberg has participated in installation restoration program (IRP) activities at six bases. At bases in Florida and North Carolina, he conducted on-site assessment of confirmation sites. He then developed work scopes for conducting confirmation work. He participated directly in confirmation assessments at bases in Florida and Virginia. Monitoring data were reviewed leading to determination of environmental degradation and the need for remedial actions. For the U.S. Army, he conducted field studies of dispersion of munitions wastes in surface waters at Holston AAP. At Longhorn and Louisiana AAP, he participated in field studies of munitions impacts on ambient water. He conducted pollutant dispersion analysis on the Clinch River (TN) to assess downstream effects of peaking power dam discharges.

In Dade County (FL) he assessed groundwater contamination from disposal of a proposed hazardous waste. Wells were sited and installed, sampling directed, and results interpreted. Evidence of pollutant movement beyond property boundaries was shown; however, hazardous constituents did not migrate far in the aquifer. Mitigation recommendations were made.

Dr. Steinberg has prepared comments for submission to the U.S. Environmental Protection Agency (EPA) addressing technical appropriateness of federal hazardous waste regulations. He has participated in EPA-sponsored workshops on Part B application filing. He has drafted two major American Society of Civil Engineers (ASCE) hazardous waste policy statements which have been presented to U.S. congressional committees. He is chairman of the ASCE Hazardous Waste Management Committee.

Education

Ph.D.	Environmental Engineering	University of Florida
M.S.E.	Water Resources Engineering	Vanderbilt University
B.C.E.	Civil Engineering	Vanderbilt University

Professional Registrations and Societies

Professional Engineer--Florida
American Society of Civil Engineers
American Water Resources Association
American Geophysical Union (Hydrology Section)

JAMES H. SULLIVAN, JR., Ph.D., P.E. **CHEMICAL ENGINEER**
WATER AND AIR RESEARCH, INC.

Relevant Experience

Dr. Sullivan has played major roles in projects involving technical work directly related to groundwater monitoring and assessment at hazardous wastes sites. His recent experience includes work for a paper manufacturer, a phosphate plant, a landfill, and a cement manufacturer.

Dr. Sullivan directed preparation of Part A and Part B permit applications for the U.S. Navy. He has also worked directly on other projects related to RCRA groundwater monitoring and assessment programs and the permitting process. He is familiar with the DOD Hazardous Materials Information System which he has used to assess chemical/physical properties of DOD compounds. He directed a team of scientists and engineers working at two installations on initial assessment studies (IASs) for the U.S. Naval Energy and Environmental Support Activity (NEESA). Potential for contamination from past hazardous waste disposal was determined for approximately 80 candidate disposal sites. Recommendations for confirmation or remedial action were developed.

At U.S. Air Force bases he conducted Phase 2 Confirmation Studies of potential contamination from past hazardous waste disposal activities. He participated in field work and used field data to assess pollutant movement and severity of contamination. He recommended remedial measures and specified additional data needs for remedial design.

He directed a series of studies for the U.S. Army in which impacts of munitions wastes at several ammunition plants were defined. Siting of a new munitions plant was the objective of another study, and developing water quality criteria for hazardous substances using field and laboratory data was accomplished in another study. He conducted field work, data reduction, report preparation and briefings.

At a U.S. Army installation (Redstone Arsenal), Dr. Sullivan directed a nationally prominant study of environmental contamination from DDT. He was responsible for devising and evaluating engineering techniques for remedial action. The project involved several public agencies, with field data collected by four separate groups. He was responsible for reducing and interpreting all field data. Again he participated directly in field reconnaissance, records research, data compilation, data reduction, report writing, and briefings, including those before Congressional staffs.

Dr. Sullivan studied three solid waste disposal sites near Charleston, South Carolina and monitored groundwater impacts. In addition to gathering chemical data on groundwater and soils, fluorescent dye was used to trace groundwater movement. Evidence of hazardous substances in leachate was found and remedial action recommended.

Education

Ph.D.	Environmental Engineering	University of Florida
M.S.	Environmental Engineering	University of Florida
B.S.	Chemical Engineering	Georgia Institute of Technology

Professional Registrations and Society Memberships

Professional Engineer--Florida
Member of 8 professional societies

Publications

Author and co-author of approximately 10 publications and 45 technical reports in water chemistry, potable water treatment, wastewater renovation, and environmental impact assessment.

JHS/HAZ.1
8/1/83

WILLIAM G. THIESS

ENVIRONMENTAL ENGINEER
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Thiess has worked with hazardous waste management at facilities in Georgia, Florida, Alabama, and Texas. He prepared major portions of a Part B application for a commercial treatment, storage, and disposal facility in Georgia. He developed concept designs for container storage and sludge fixation (solidification) facilities. He developed all topographic information and process descriptions, and he designed plans for waste storage and handling.

Mr. Thiess prepared major portions of a Part B application for a Naval Air Station in Texas. He helped develop plans and specifications for a container storage building and vaulted, below-grade storage tanks. He prepared detailed facility descriptions. He has interfaced directly with permit agency staff to negotitate permit conditions.

Mr. Thiess has participated in initial assessment studies (IASs) of hazardous waste contamination at U.S. Marine Corps and U.S. Navy installations. For a naval shipyard, he was also responsible for developing recommendations for further groundwater assessment and remedial actions where contamination was apparent.

Mr. Thiess evaluated engineering alternatives for isolation or detoxification of DDT-contaminated sediments near Huntsville, Alabama. His primary role in this project was to select, design, and cost various mitigation alternatives. He also helped evaluate relative alternative effectiveness.

In another groundwater contamination study near Redstone Arsenal (Alabama), he supervised well sampling and laboratory analysis of hazardous organics according to rigid field and laboratory procedures.

For the U.S. Army Corps of Engineers (COE), Mobile District, he directed efforts to identify and assess impacts upon physical systems for the Coosa River Navigation Project environmental impact statement. For Savannah District, he supervised and participated in field work and data analysis for the Richard B. Russell Dam pre-impoundment study.

He has participated in and directed portions of Section 208 projects in central Florida. He developed water and nutrient budgets for the Winter Haven chain of lakes in a study designed to evaluate restoration alternatives for Lake Howard. He was also responsible for design and implementation of a study to evaluate effects of septic tank drainfields on water quality in three central Florida lakes.

While a graduate research assistant at Clemson University (1978-1979), he was responsible for organizing and directing stream survey field work for a project sponsored by the U.S. Environmental Protection Agency (EPA) designed to evaluate the effectiveness of control measures for nonpoint source pollutants. He supervised laboratory work in sediment transport analysis and applied various digital computer models to drainage basins for erosion and sediment transport analysis. He dealt with various state and federal agency personnel, as well as local interests, during organization and implementation of the project.

Education

M.S.	Environmental Engineering	Clemson University
B.S.	Environmental Engineering	Florida Institute of Technology

Professional Organizations

Chi Epsilon
Water Pollution Control Federation
American Water Works Association

APPENDIX I

AGENCY CONTACT LIST

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